SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL

No. 99 AUTUMN 1956

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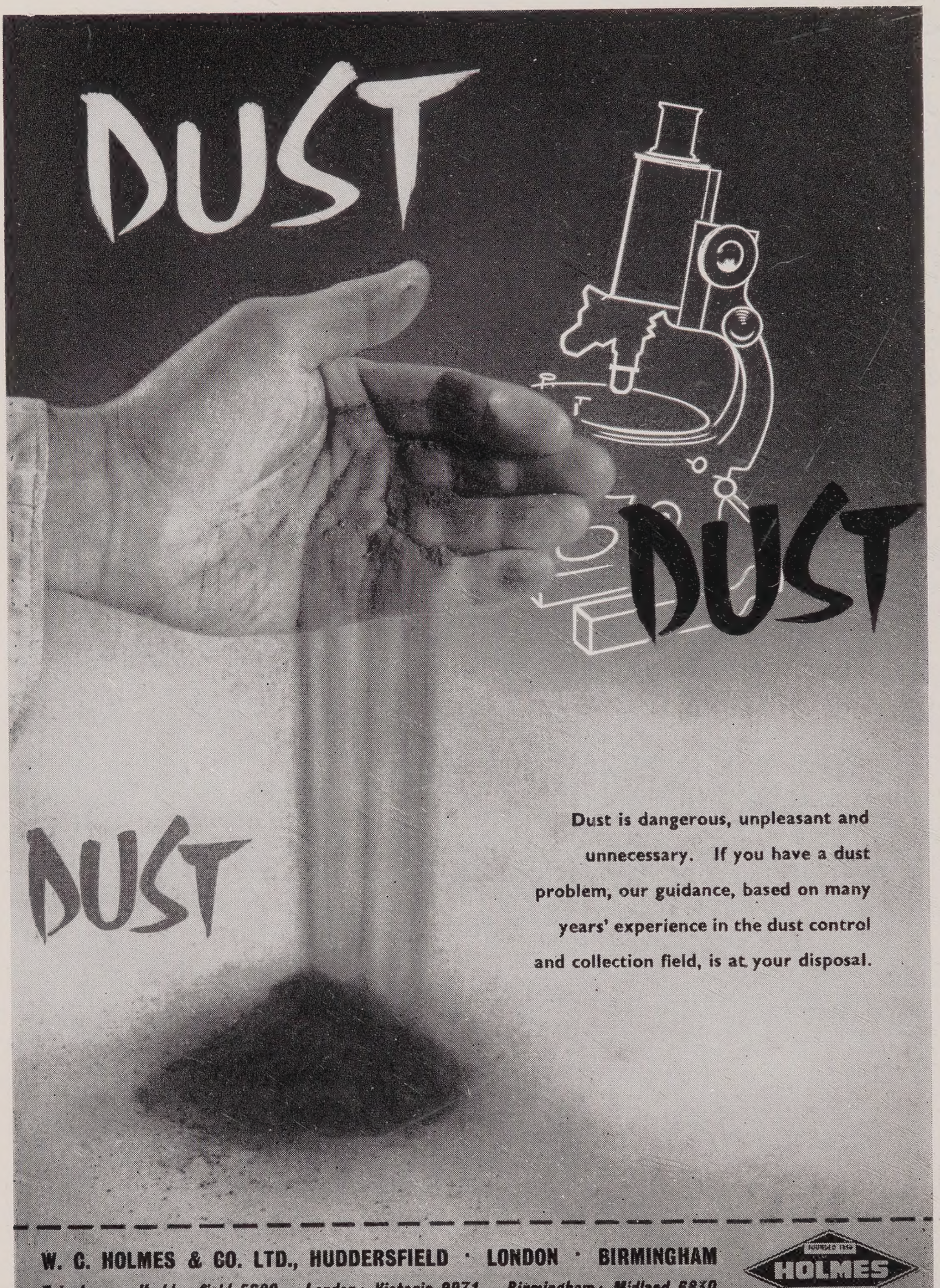
In this Issue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SMOKELESS AIR

Vol XXVII. No. 99 Autumn 1956

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MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership application form will be sent on request.

N.S.A.S. Notices

Clean Air Act. Please note the announcement on page 10 about the publication of the Society's "Summary of the Clean Air Act," and information on other topical publications that may be purchased from the Society.

Films List. The Society has available a descriptive list of films that are available on loan from various sources, relating to air pollution and fuel and power subjects.

Display Material. A new descriptive list of the Society's exhibits, posters and other display material, including new items, is now available and will be sent on request.

Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

Comment

The Clean Air Act

ON 5th July, 1956, the Clean Air Bill received the Royal Assent and became the Clean Air Act. In the lengthy history of the fight for a purer atmosphere the date marks the end of a short but vital chapter—a chapter that opens with the London smog disaster of 1952, and includes the Beaver Committee and its report, the Nabarro Bill, and finally the Bill that has become the new Act.

The date also begins a new chapter, which the future historian may well entitle " How the Clean Air Act was Implemented." It is this now, rather than what has gone before, which interests us. Many criticisms were made, rightly and usefully, when the Bill was first introduced, with the result that it was considerably improved during its passage through Parliament, and the Act as it now stands is a measure that, if it is used to the full, may well confound any remaining critics. It is by no means perfect, but the essential point now is that it is the Act, and that the local authorities and the smoke abatement movement (if that phrase may still be used) are in effect firmly wedded to it, for better or for worse.

It will be some time before the Act gets fully under way. The Government intends that the provisions in the Act relating to the establishment of smoke control areas should become operative before the end of 1956, and that the other provisions, mainly affecting industry, should come into operation early in 1958. As the Earl of Munster, Minister without Portfolio, said in answer to a question by Viscount Thurso, these dates accord with the recommendations of the Beaver Committee, and the interval is designed to allow time for industry to improve or alter plant in order to be able to comply with the Act. " The main stimulus for such improvements," he added, " is provided by the requirements of the Act itself."

The Minister has still to make the regulations relating to allowable dark smoke, the processes to be scheduled for control by the Alkali Inspectorate, the regulations concerning dust and grit control, and the composition of the Clean Air Council. And, of course, the temporary exemptions section will remain in force until 4th July, 1963.

The interim period can usefully be employed by local authorities in preparing to administer the Act and in making its meaning known to industry. The manufacturers of the equipment that will be needed by a great many firms to put their plant in order have a breathing space to investigate the market and to plan their production accordingly. The problems of smokeless fuel availability for smoke control areas are already under active study and development, as papers to be read at the forthcoming Southport conference will show. As for the Society, on the information and propaganda (or educational) sides, the problem is not what to do but how to cope, on its limited means, with the calls that are increasingly being made for service of many kinds. The clean

air campaign is, in short, entering a period of intense activity. If this were not the case then the Clean Air Act would, through no fault of its own, already be beginning to fail.

The Final Stages

On another page we print excerpts from the House of Lords speeches on the Bill. Several useful amendments, proposed or supported by the Government, were incorporated, although a number that were still desired by the Society, and which were moved by Lord Milner of Leeds, were not accepted. The Society is most grateful to Lord Milner for his valued, even though unrewarded, efforts.

The amendments that were carried included one to Section 3 (smoke from furnaces) that closed a loophole in respect of outdoor installations. Another, again in Section 3, defines furnaces for domestic purposes as furnaces with a maximum capacity of 55,000 B.Th.U's per hour. This means that a large furnace serving a block of flats, though being used for domestic purposes, is not a domestic furnace for the purpose of the Act. A similar amendment was made to Section 5, which is concerned with the control of dust and grit. The outdoor furnace question was further clarified by incorporating an entirely new section (9 in the Act) so that, in respect of grit and dust, outdoor furnaces are brought into line with furnaces in buildings.

In Section 19, which concerns vessels, an amendment was made to restrict action by local authorities to vessels that are " within the seaward limits of the territorial waters of the United Kingdom." As Mr. Enoch Powell pointed out to the Commons, there was little likelihood of a local authority wanting to take action against a vessel more than three miles from the coast, but that it was desirable to have the wording right.

Another new clause, now Section 21, which had been supported by the Society and other bodies, is to the effect that a local authority may exempt from action under the Act any premises in which investigations or research are going on and which may result in smoke, etc., emission for the time being. It is laid down that the research has to be relevant to the problem of the pollution of the air. The only other amendment made by the Lords was in Section 31, where a new wording sets out more clearly the smoke control responsibilities of a local health authority and a port health authority.

Our Summary of the Act

The synopsis of the Clean Air Bill published in our last issue has now been revised, to conform with the final amendments made to the Bill, and has now been published in pamphlet form under the title " Summary of the Clean Air Act, 1956." Readers are advised not to use the original version for reference purposes because it is now incomplete and the section numbers are different from those in the Act. In addition there were one or two minor errors of interpretation that have now been corrected. In view of the length and complexity of the Act, which runs to thirty-seven sections, the summary provides, we believe, a very handy and easily consulted guide that should be of value to members and officers of local authorities as well as to many others. The price is only sixpence, or 4s. 6d. per dozen copies, post-free.

Industry Looks at the Act

Industrial reactions to the Clean Air Act, as expressed in their own publications, are of interest. Thus we find *The British Clayworker* expressing concern about Section 15 (smoke nuisances), which allows for a " best practicable means " defence in the case of smoke emitted from a chimney. This is regarded as unfair to brickmakers who burn their bricks in open clamps, and the suggestion is therefore made that if the clamps are under a Dutch barn type of cover this should be opened in the centre and a smoke-

slot, projecting four feet above the roof, inserted, so as to provide what would legally be a " chimney " under the Act.

A group of the Incorporated Plant Engineers, discussing the Act, are reported in their *Journal* to have agreed that the dark smoke mentioned in the Act is " the most economical colour," and that "the only way to lighten it is by introducing excess air with a consequent loss of efficiency." As Fuel Research Technical Paper No. 55 demonstrates, this is quite a mistaken idea.

A broadsheet of the British Cast Iron Research Association is very frank in its advice. After pointing out that any attempt to control completely the various emissions met with in the foundry industry would be extremely difficult and expensive, it says: " The proximity of a foundry to a housing area must inevitably make it vulnerable to complaints, captious and otherwise. Many areas, such as the Black country, have become used to a substantial measure of air pollution, and conditions will frequently be tolerated in such an area that will not be tolerated in areas which are not primarily industrial. In spite of this, however, in industrial areas, every attempt should be made to minimize emissions of all sorts to prevent a build-up of public opinion, and it is politic to make it known locally that these attempts are being made, since this in itself serves to reduce the pressure of public opinion."

C.B.E.

All members of the Society will join in congratulating our Past-President, Alderman Professor F. E. Tylecote, on the distinction of receiving the Companionship of the Order of the British Empire. Alderman Tylecote is a man of so many distinguished parts that for him the phrase " public services " has a much wider meaning than for most people—including as it does, medicine, public health, local government work, and of course, clean air. As an eminent medical man, former Professor of Medicine in the University of Manchester, Alderman of the Manchester City Council, Chairman of the Health Committee of the Association of Municipal Corporations, Past-President of the Society—to name but a few of his interests and offices—the letters C.B.E. fall in after his name with a natural ease and dignity.

Southport

Preparations for the Southport conference are now complete and the papers are being printed for advance distribution to delegates. Without exception they are, in their different ways, interesting, stimulating, informative and—in some cases—provocative. Discussions should be good. Also of interest is the record number of delegates registered to attend. With two months to go this had passed last year's figure, which was itself a record, and at the time of going to press the 650 mark was being approached. A word to delegates: don't overlook the informal " get together " at the Palace Hotel on the Tuesday evening, before the conference opens. Last year's experiment with this free-and-easy, no-programme gathering was most successful in enabling members of the conference to meet old friends and make new ones.

Care for a Swig?

The latest anti-smog device is a pocket container, presumably carried on the hip, with which, whenever the atmosphere is too much for you, you can use to give yourself a whiff of oxygen. Presumably it can also be used for other emergencies, like overcoming the effects of an unexpected glimpse of a famous movie star, or of climbing to your office near the top of a skyscraper when the elevator breaks down. For it comes, naturally, from the U.S.A., and from the press reports that are the source of our information it would seem to rejoice in the name of " Oxy-Swig." It is said to be safe and reliable, and although it costs £10 or more, this is declared to be a deductible expense for income tax purposes!

The Bill before the Lords

We print a few excerpts from the speeches on the Second Reading of the Clean Air Bill in the House of Lords (24th April) and from the Committee Stage on 30th May. The Committee discussions recorded are perhaps of somewhat technical (in the legal sense) interest, but for that reason they may be of some value to those who will be concerned with the future interpretation and administration of the Act.

LORD MILNER of Leeds: Before considering how far the Bill goes towards implementing the Committee's recommendations, it is essential to realize the magnitude of the work which has to be done; because it is only when one looks into the problem of smoke and smog in this country that the problem is seen in its proper perspective. The Government propose to get rid of smog within the next ten to fifteen years. There are something like 12 to 14 million houses in Great Britain; there are perhaps 1 million or more commercial and similar buildings and more than half the latter are in what the Committee called " black areas." Those cover 6,000 square miles, equal to some 4 million acres of land. Thus if we try to dispose of this question and to minimize the evil, something like 300,000 to 400,000 acres a year will have to be tackled. On its face that would seem an almost impossible task, especially when one remembers that since the war only 3,000 acres have been so dealt with. Then, added to the premises I have mentioned there are some 200,000 factory chimneys and 20,000 steam engines, all of which come within the purview of the Bill. Finally, there is the question of dust and grit deposit. In some areas of my own city of Leeds, 30 to 40 tons of dust and grit are deposited per square mile in the course of a year. Much of that is due to the proximity of power stations and it is well to bear in mind that power stations, especially the old ones, are prime offenders in the depositing of dust and grit. Those figures indicate the tremendous size of the problem; and to deal with it as we hope to do will require a great effort over a long period of time.

How far does the present Bill go? It is not always easy to follow, but clearly a brave start has been made, and the original Bill has been vastly improved during its passage through another place.

The Lord Bishop of Sheffield: My Lords, I should like to join in welcoming this Bill, and, indeed, to congratulate the Government in bringing it forward so quickly after the publication of the Beaver Report. My apology for speaking on a Bill which in many of its provisions is technical is that I have lived and worked all my days in an area where the air has been unclean and polluted. I know only too well the ill effects of air pollution on man's life and work and on his physical and mental health, and something, too, about the economic cost of wasted fuel and damaged buildings.

Whilst I am extremely grateful for this Bill now approaching the Statute Book, I must say that I find it rather disappointing in some respects. Without seeming to get what I say out of bearing, I should like to probe a little some of the defence and exemptive clauses which are scattered rather plentifully through the pages of the Bill. First of all, with regard to smoke, as the noble Lord, Lord Milner of Leeds, pointed out, up to now byelaws under the Public Health Act, 1936, have been operating without any legal defence clauses in respect of the emission of dark smoke. I think it is a matter of great regret to many

local authorities up and down the country that these defence clauses should be in this Bill. Is it seriously suggested that local authorities and their inspectors have been persecuting industry and bullying? Surely not. Why this tremendous play with evasive phrases like "unsuitable" and "as far as is practicable" in the Bill, over which I imagine lawyers can argue happily for a good deal longer than seven years? I am informed by technical experts that it would be possible to list all unsuitable fuels and therefore to avoid so vague a phrase as "unsuitable." As has been pointed out already, with up-to-date appliances and good stoking almost any fuel can be burned without the emission of any large amount of offensive smoke.

Lord Macdonald of Gwaenysgor: As I have already said, there is no shortage of legislation. Suppose we pass this Bill, and it becomes an Act of Parliament. What guarantee is there that it will do the job? What guarantee is there that the Bill will "do the necessary"? What guarantee is there that in the industrial areas men, women and children will then enjoy clean air? How right the right reverend Prelate was! Those of us who can afford to live elsewhere do not live in those areas. I say, quite frankly, that when I could I got out of those areas; I got to cleaner air. I left the Wigan area; I left Lancashire. During my lifetime I looked from time to time for cleaner air, and I went to North Wales. Those who live in the industrial areas maintain their health because they get away for periods to cleaner air. It is not legislation that we have been short of, but the taking of action. There is sufficient power in the existing legislation to do very much more than has been done.

Where does the fault lie? One does not want to apportion blame, but the local authorities in many areas might have done much more than they have done. Clause 27 of this Bill states that the local authorities are to be responsible in future for the enforcement of these provisions. I was delighted that on the first day in Committee in another place the Minister of Housing and Local Government gave this undertaking

"I am prepared to give the Committee an assurance that when the Bill becomes an Act I will consider whether it would not be appropriate for me to send a circular to local authorities saying that, in view of the passage of the Bill and the obvious intention of Parliament to make a drive in this respect, we look to them to exercise their powers on smoke. . . ."

I trust that he will not only "consider" doing that but that he will take that action. For some reason or another, local authorities have been remiss in the past in exercising the powers entrusted to them to deal with this very same problem. We want to make sure that local authorities in the future are encouraged by the Minister to take more action to deal with all offenders.

The Earl of Munster (Minister without Portfolio): The question was asked whether my right honourable friend would consider in the Bill an Amendment providing for annual reports to be presented to Parliament. I am not sure whether it is necessary to include such a provision in this Bill but I will take the matter up with my right honourable friend in due course. I can, however, assure noble Lords that it is the intention of my right honourable friend to produce an annual report to Parliament in the years that lie ahead, so that noble Lords and Members of another place will be able to follow exactly what has been done by local authorities to implement the provisions of the Bill. The right reverend Prelate suggested that he thought there were too many "practicables" within the Bill. Let me assure him at once that the definition of "practicable" has been revised and in some respects has been considerably tightened up since the Bill was introduced; but I will most certainly go into the matter again to see whether it is practicable to tighten "practicable" still further.

Earl Jowitt: What is the position of a man who is using an old-fashioned furnace, which is more likely to emit smoke than a modern furnace? I know that the Beaver Report says that much money must be spent on modernization. Suppose the man has done the best he can with the furnace he has got, but that furnace is an old-fashioned furnace and he cannot prevent it from emitting smoke, but there would be no danger of smoke if he got the furnace modernized: what would be the position of that man under the Bill? Perhaps the noble and learned Viscount can clear up that point.

The Lord Chancellor (Viscount Kilmuir): I am obliged to the noble and learned Earl. I gave one example in relation to paragraph (*a*); that is, the defence from heating up. There, as the noble and learned Earl will see, the first requirement the defendant has to prove is

" that the contravention complained of was solely due to the lighting up of a furnace which was cold. . . .".

There I take it that his defence would fail (this was stated without challenge by my right honourable friend in another place) if it was due to inadequate plant or out-of-date machinery, or the like, because then it would not be solely due to the heating up. With regard to paragraph (*b*) the noble and learned Earl and I have often in the past had to consider this sort of question in Factories Act cases. But paragraph (*b*) begins:

" . . . the contravention complained of was solely due to some failure of a furnace or of apparatus used in connection with a furnace."

Then there are the two provisions dealing, broadly, with negligence, where it says, either,

" that that failure could not reasonably have been foreseen, or, if foreseen, could not reasonably have been provided against . . .".

We have often had it said in the past that if you have an old or out-of-date machine you have constructive knowledge of these points.

Lord Moyne: Before the noble and learned Viscount sits down, could he explain the apparent contradiction between the word " solely " in paragraph (*a*), which he has several times stressed, with the inclusion of paragraph (*a*) in paragraph (*d*)? There seems to be a contradiction. It is a difficult thing to reconcile the two. I daresay the noble and learned Viscount's clear mind can clear the question up straight away; but if not perhaps he will look at it later.

The Lord Chancellor: I am grateful to my noble friend. If your Lordships look at paragraph (*d*), you will see that it says

" that the contravention complained of was due to the combination of two or more of the causes specified in paragraphs (*a*) to (*c*) of this subsection . . .".

I agree that it appears to cause a difficulty, but I do not think it actually does. I think my noble friend will see it if he considers it in this way. Paragraph (*d*) deals with a combination of the causes. Therefore, there has to be, say, a heating up or a breakdown in plant. But the heating up, in so far as it is the heating up which comes into the picture, must be only the heating up; as I have pointed out to the noble and learned Earl, the obsolescent state of the plant must not be the cause. Equally, when you are dealing with the second part, that there has been a breakdown in plant, the emission must be due to the breakdown and not to any pre-existing causes which make that breakdown likely and then bring you within the other portions of this clause. In other words, we come down to sub-species, but each sub-species must be the sole cause, the primary reason; there must not be any attempt to shelter in that primary reason for the obsolescence of your plant. I am sorry if it is not very clear. I will take another course in metaphysics and try to make the theory of

causation clearer to my noble friend on the next stage of the Bill.

Lord Chorley: I listened to the noble and learned Viscount's explanation of the point which was put to him by the noble and learned Earl on the question of a rather old-fashioned furnace, but I found it rather difficult to agree with him. I appreciate that it requires certain temerity to disagree on a point of construction with a lawyer of the eminence of the noble and learned Viscount the Lord Chancellor, but every lawyer appreciates that questions of construction are notoriously difficult. I should myself have thought that the obsolescence or not of the furnace had really nothing to do with this question. The contravention complained of must be wholly due to the lighting up of a furnace which was cold; and if, in fact, the furnace was a rather old-fashioned type which was lighted up from cold, it would be solely or, at any rate, arguably solely, due to that particular furnace's being lighted up from cold. I think that that is a point of view which a bench of magistrates might well take in coming to a conclusion. After all, they have to look at the matter from the point of view of the making out a case by the prosecution against the defendant on a criminal charge. There has to be a case made out beyond reasonable and probable doubt.

The Lord Chancellor: Would the noble Lord allow me to intervene? That is exactly what they have not to do. In this case, once the emission of dark smoke is proved the onus shifts to the defence. It is then for the defendant to prove his defence, not beyond all reasonable doubt, but to prove it as defences have to be proved —that is, by substantial preponderance of the evidence. It is not a question of the prosecution proving its case, but of the defence proving theirs.

" *Practicable* "

The Lord Bishop of Sheffield: moved in the definition of " practicable," in subsection (1), to leave out " to local conditions and circumstances, to the financial implications and ". The right reverend Prelate said: It seems to me that the Bill is wise not to try to define too closely the word " practicable." I think it is good also that in this clause emphasis is laid on the importance of developing more efficient plant. I am sorry that it singles out, and not just leaves amongst the other things which are bound to be considered, " local conditions and circumstances " and " financial implications ". If I were making a speech on this subject in public, I would have used the phrase " local conditions and circumstances " to enforce my argument that in the East end of Sheffield the local conditions and circumstances are so bad that it is particularly important to make this Bill operative in that area. I am told—here I stand under correction if I am wrong—that in a document of this kind, when you refer to " local conditions and circumstances ", you mean exactly the opposite. If local conditions and circumstances are so very bad, you must, as it were, modify the regulations rather than stiffen them. In other words, if we are dealing with some clean-air country village, the local conditions and circumstances are such that we should be very severe with anybody who emits dark smoke from his chimney, but when dealing with Sheffield, where there are a great many chimneys emitting dark smoke, our requirements are toned down. So that the phrase " where practicable " means a watering down, rather than a tightening up, of the measure, and it does not excite me at all.

Again, if, by " financial implications ", is meant the total cost, not to any particular industry but to the community, there is no objection to the phrase. But again I imagine that it means primarily the financial implications to a particular industry. Therefore, in this definition of " practicable ", while I am glad that it stresses the importance of technical developments, I should much rather leave " local conditions and circum-

stances " and " financial implications " to be considered, as they are bound to be considered, " amongst other things."

The Lord Chancellor: I think the right reverend Prelate has been a little pessimistic in his approach to the wording in the Bill, and I hope to satisfy him on the point. I promised the noble and learned Earl, Lord Jowitt, earlier this afternoon that I would refer to the law on the matter, and I hope that your Lordships will bear with me if I indicate what it is. However, before doing that I should like to deal with one or two general points. The right reverend Prelate will remember that the word " practicable " occurs in several places in the Bill, and its definition has already been revised in the light of the discussion in the other place. The essence of the definition is that the word is to be construed as meaning not only what is physically practicable but what is reasonably practicable; and that, it is thought, must necessarily entail having regard to the local conditions and circumstances and the financial implications, amongst other things. I do not think the right reverend Prelate really is doubtful on that point although he dislikes the pinpointing of these two matters.

In these circumstances, it is right to look at the ancestry of the clause to see whether it has worked in the past. References both to " local conditions and circumstances " and to " cost " already occur in the corresponding definition in Section 110 (2) of the Public Health Act, 1936, which relates to the prevention of public health nuisances, including smoke nuisances. The words also appear in Model Clause 76, which relates to smoke from industrial furnaces, and in local Act provisions based on the Model Clause, including Section 36 (4) of the Manchester Corporation Act, 1946. With regard to the fear of the right reverend Prelate that the reference to " local conditions and circumstances " might be taken to mean that less stringent methods of prevention would be required in a heavily polluted area than in an unpolluted one, the intention, of course, is exactly the reverse. It is intended, for example, that the requirements of Clause 17 should be less exacting if practical difficulties were encountered in the case of a colliery spoilbank in a remote part of the country than in the case of a spoilbank on the edge of a built-up area. Having regard to the purpose of the relevant provisions of the Bill, it is not thought that any court would construe the words in the definition in the way that is apparently feared.

Perhaps I may now turn shortly to the way in which legal decisions have progressed. On consideration of the decisions, it is doubtful how far the Amendment which the right reverend Prelate has moved would have the result intended. In the first place, it is thought that a consideration of what is reasonably practicable includes not only a consideration of local conditions and circumstances and the financial implications, but also of all the relevant circumstances; and that is achieved here by the words " amongst other things ". In the second place, on the analogy of the interpretation given to the expression by the courts, and particularly your Lordships' House in its Judicial capacity, in recent cases on mines and factories legislation, it is probable that the courts would construe the expression as it is defined in the Bill —I say " probable ", because I cannot say that it is certain. In older cases on smoke legislation in the middle of the 19th century it is apparent that the courts did not then require as high a standard of care in the execution of a duty which was to be carried out " as far as practicable " as has been called for in recent decisions in mines and factories cases. Accordingly, the Bill makes it clear beyond doubt that the gist of the modern decisions is followed in modern smoke legislation.

I hope I have made that somewhat technical point clear: that by the words one has tried to catch up the modern decisions and not the older

decisions which took an easier and more relaxed view. The effect of the modern decisions is that " reasonably practicable " does not mean, as I said " physically possible "; that the court must look at the situation as it was immediately before the breach of the obligation is alleged to have occurred —and, indeed, at all the surrounding circumstances; and from this it follows that it is not reasonably practicable to guard against a contingency which could not reasonably be foreseen. Among the factors which have to be considered are, first, the cost of the measures necessary for avoiding the risk or mischief, and the time and trouble involved in taking them; and secondly (and this is the one I would emphasize particularly to the right reverend Prelate), the seriousness of the risk or mischief to be provided against. In this connection it has been repeatedly stated that the greater the risk or the mischief the less weight will be given to the factor of cost. That may be some consolation to the right reverend Prelate in the fear which he has expressed. Thirdly, among the factors to be taken into account is the effectiveness of the measures which it is alleged ought to have been taken; and fourthly, the soundness of the system adopted.

Those precautions, which have worked successfully for a number of years, will normally be held to have shown quite plainly that the requirement is to do what is " reasonably practicable." I always hesitate to introduce these words when dealing with legal matters, because so much has been said to the contrary since, but I do not think it is putting it too high to say that all the courts have done is to apply some rules of common sense to the conception of what is reasonably practicable. It is impossible to give an exhaustive list of all the circumstances which may turn out to be relevant, but common sense will usually supply the answer. Therefore, I think that what we have done in seeking, as I have said, to catch up these modern conditions here, and not get back to the older ones by misadventure will not have an adverse effect. I hope that my somewhat lengthy disquisition has been of some consolation to the right reverend Prelate and that he will not press his Amendment.

" NEW KING COKE "

The Gas Council has produced a film about coke that by an amusingly novel approach has overcome the difficulty of creating interest in a subject that on the face of it can hold little entertainment value for a lay or junior audience. This has been done—in Eastmancolor—by using puppets and humans side by side. The story tells of a puppet woodcutter who discovers the advantage of turning wood into charcoal to produce a clean, smokeless fuel. After failing to convince the royal household of its value (they insist that the charcoal should be cheaper because the goodness has been taken out of it!) he consults an alchemist who tells him that the 20th century is much more interested in smokeless fuel—and assists him to make a journey through time to the present day. He lands in the real Piccadilly Circus and is taken around—this is where the real life comes in—to be shown and told about the making and uses of the modern version of his smokeless fuel, coke. He returns to his own time with a bag of coke, the fire from which so pleases the royal court that he is given the hand of the lovely princess as his reward.

The film, which runs for 20 minutes, is well and colourfully produced, and should prove to be popular for many types of audience. More information may be obtained from the Films Officer, Gas Industry House, 1 Grosvenor Place, S.W.1.

CLEAN AIR CAMPAIGN IN WEST MIDLANDS

Biggest Propaganda Drive

September 10th saw the official opening, in Dudley, of the biggest co-ordinated clean air campaign yet planned, which will continue throughout the winter and end in the middle of April next year. The initiative for the campaign came from the Technical committee of the Midlands Centre of the Sanitary Inspectors' Association. Support was readily forthcoming from the Solid Smokeless Fuels Federation, which has taken a lead in the organization of exhibitions and area campaigns, and from other bodies: the National Smoke Abatement Society, the Fuel Research Station of the D.S.I.R., the Midlands Gas and Electricity Boards, and from the women's organizations, including the Electrical Association for Women, the Women's Gas Council and the Women's Advisory Council for Solid Fuel. Fourteen local authorities agreed to collaborate and an exhibition will be held in each town.

With the promise of static exhibition material from the main exhibitors, the local authorities agreed to the provision of the necessary halls, as it was desirable to support the main exhibition by talks and films, with the utilization of mobile exhibitions at various sites within the area. The local arrangements have been left entirely to the local authority, giving their responsible officers the opportunity to create their own programmes and to arrange for publicity.

The Society is co-operating by providing an entirely new exhibit, which consists of four units designed so as to facilitate packing and transport. This material will be available after the present campaign for loan to members, although in view of its cost (and the cost of maintenance) a loan charge may have to be made. It is hoped to illustrate one or two of the units in the next issue, which will also contain a report of the first weeks of the campaign, with a report of the official opening at Dudley, by Sir Hugh Beaver.

PROGRAMME FOR THE WEST MIDLAND CAMPAIGN

1956		
Sept 9 to 15	..	Dudley
23 to 29	..	Darlaston
Oct. 7 to 13	..	Stoke-on-Trent
14 to 20	..	West Bromwich
21 to 27	..	Halesowen
Nov. 4 to 10	..	Wednesfield
18 to 24	..	Oldbury
Dec. 2 to 8	..	Wednesbury
1957		
Jan. 20 to 26	..	Wolverhampton
Feb. 3 to 9	..	Coventry
17 to 23	..	Nuneaton
Mar. 3 to 9	..	Rowley Regis
17 to 23	..	Walsall
Mar/Apl. 31 to 13	..	Birmingham

Bronchitis and Air Pollution

Sheffield University has approved a proposal by the Medical Research Council to establish within the university a group for research on the epidemiology of respiratory diseases. The group, which will be under the direction of Dr. J. Pemberton, the senior lecturer in social and industrial medicine, will concern itself principally, at least at the start, with investigating the relationship of air pollution and atmospheric conditions to chronic bronchitis. It is expected that the environmental aspects of lung cancer will also be studied.

From our Photo-Library, No. 26 *H. G. Trodd, F.R.P.S.*

Collier's Cargo

NEW SMOKELESS ZONES

Smokeless zones came into operation on 1st July in Birmingham and Preston. In Birmingham there is now a central area zone of 93 acres, and another area of 110 acres in Garrett's Green, on the eastern side of the city. The central zone is mainly commercial in character, with 1,978 separate occupiers using 10,248 appliances and previously consuming nearly 10,000 tons of bituminous coal a year. The other area is at present comparatively undeveloped, but is planned for industrial use. Because of the proximity of the Elmdon airport the height of future chimneys will have to be restricted and it was considered essential that, to protect the amenities of nearby modern housing developments, all future fuel-burning appliances should be smokeless.

The smokeless zone in Preston is the town centre, bounded by Fishergate, Church St., North Road, High St., Wharf St. and Corporation St.

Smokeless Zone Planned

According to a report in the *Sheffield Telegraph*, the city's Medical Officer of Health is preparing a scheme for a smokeless zone, which would be in the city centre. It is also hoped that the first two areas of major redevelopment in the city—a scheme of flats at Park Hill and replanning at Netherthorpe—would become smokeless zones.

Obituaries

JOHN W. BEAUMONT

It is with sincere regret that we report the death on 27th June, 1956, at the age of 72, of Mr. John W. Beaumont.

Mr. Beaumont retired in 1949 from the post of Chief Sanitary Inspector to the County Borough of Halifax, which he had occupied with distinction since 1928. He joined the Sanitary Inspectors' Association in 1911 and later became a Fellow of the Association. He was past-chairman of its North Eastern Centre and a member of the General Council for many years, and was a staunch supporter of the interests of sanitary inspectors.

Mr. Beaumont became an assistant sanitary inspector at Huddersfield in 1911, and later at York. He joined the army in 1915 and in 1918 was commissioned in the Labour Corps. After demobilization he returned to York and was chief assistant and special drainage inspector until 1924, when he became Senior Sanitary Inspector at Batley. He was an examiner of the Royal Sanitary Institute and Sanitary Inspectors' Examination Joint Board, and a Fellow of the Royal Society for Health.

He took a very active part in smoke abatement work and was for many years a member of the Executive Council of the National Smoke Abatement Society and for a time its Deputy Chairman. He was elected a Vice-President of the Society on his retirement. He was also Chairman of the Yorkshire Divisional Council of the Society from 1951 to 1953 and for a number of years had been Chairman of the West Riding of Yorkshire Regional Smoke Abatement Committee.

He was a man of strong and upright character who dedicated himself to his work. He knew the tinsel and squalor of life in industrial towns and he worked hard to remedy these things. He had intense drive and determination, but when one got to know him one found a man of great kindliness and modesty. We, his colleagues and his friends, have the warmest recollections of J.W.B. He lived every moment of his life and died a fulfilled man. He indeed served his generation well.

To Mrs. Beaumont, her daughter and two sons, we extend our sympathy and trust they may find solace in the knowledge of the esteem that her husband was held by his colleagues.—*H.M.*

F. G. McHUGH

We regret to record the death, on 30th May, of Mr. Francis George McHugh, a former member of the Society's Executive Council and a valued and active member of the East Midlands Divisional Council. He was 68.

Mr. McHugh, until his retirement a few years ago, had been Chief Sanitary Inspector for Leicester. He and his predecessor had held the office between them for almost 80 years—believed to be a record for any local authority. His biggest task at Leicester was slum clearance, but his interest in smoke abatement was very real, and was sustained after his retirement, when he became an individual member of the Society. He was a Fellow of the Royal Society for Health, and a Fellow of the Sanitary Inspectors' Association.

ALDERMAN J. E. SWAIN

Another loss was sustained by the East Midlands Division by the death, on 30th April, of Alderman John Edward Swain, O.B.E., of Peterborough. He was an active member of the East Midlands Divisional Council and last year was elected Deputy Chairman. In accordance with custom he would have become the next Chairman. Alderman Swain was a leading personality in the life of Peterborough, and was mayor of the city in 1946-7.

SMOKELESS FUEL RESEARCH AT STOKE ORCHARD

FOLLOWING an international conference on "Chemical Engineering and the Coal Industry" at the National Coal Board's Research Establishment at Stoke Orchard, near Cheltenham, an "Open Day" and Press visit was held on 29th June. An earlier account of the work being done at Stoke Orchard was published in *Smokeless Air* in the Autumn, 1951, issue, and it was therefore interesting to observe the changes and developments that had taken place since then—especially as the work now being done under the direction of Dr. Bronowski is very largely concerned with the production of new smokeless fuels.

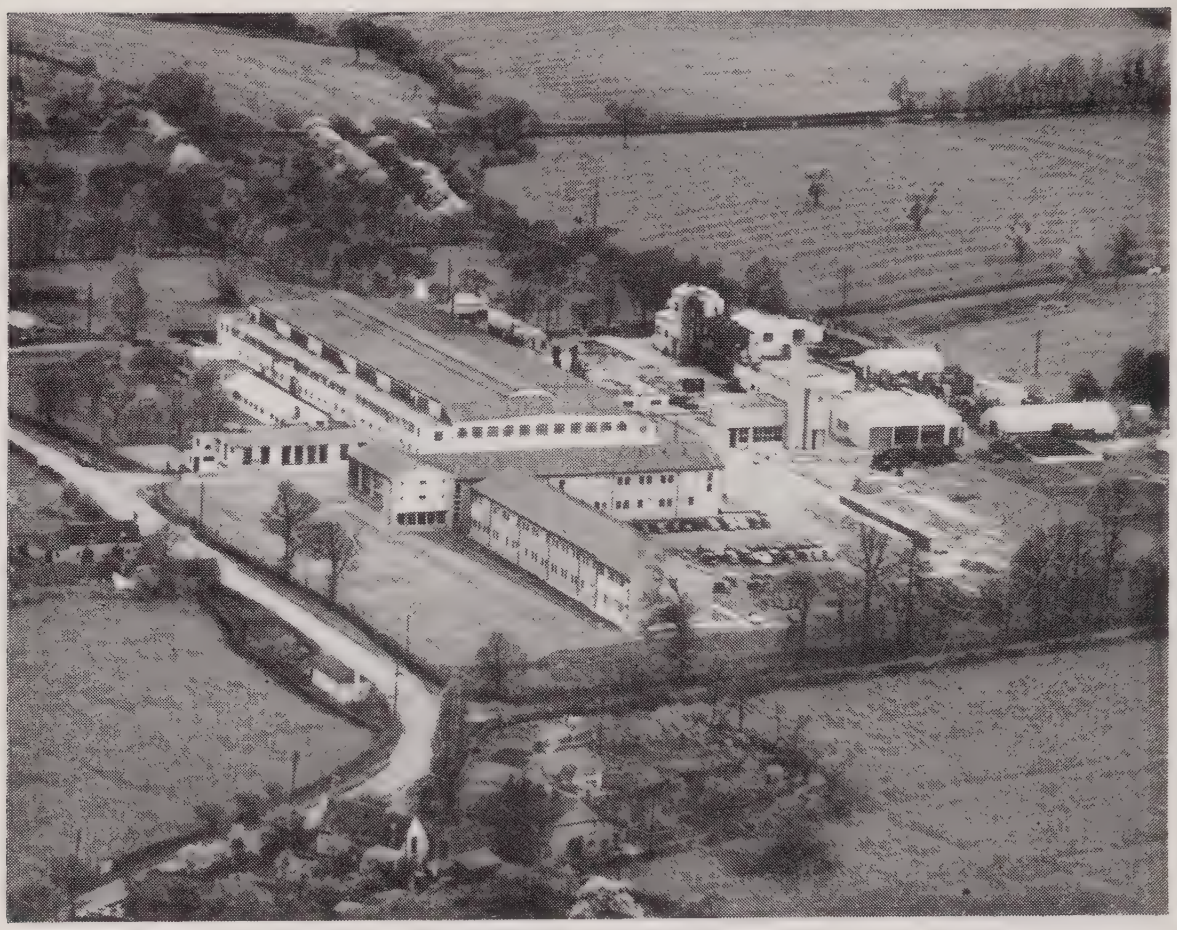
"Numerous processes," it was pointed out to the Press party, "have been put forward in the past for the production of smokeless fuels. With a few notable exceptions these processes have failed, and large sums of money have been lost. In view of this wealth of bitter experience, any new approach to the problem must proceed cautiously, and the modern technique of advancing from the laboratory investigation through the pilot plant stage to the full scale plant has therefore been adopted. Such an approach may give the superficial impression of being slow, but in fact is probably more rapid and is undoubtedly cheaper than that of large scale experiment and adaptation.

"The Coal Research Establishment has therefore been organized along the lines of laboratory and pilot plant into a number of Departments, each concerned with a particular technique. For example, for a domestic fuel, the ash content must be low, and therefore problems associated with the cleaning of coal, particularly fine coal, are the subject of study by a Coal Preparation Department. Problems arising from the carbonization of coal and of briquettes are the province of a Carbonization Department. Supporting these and other technical Departments are fundamental groups or Departments of Chemistry and Physics."

The principal sections of the work in progress that was inspected may be described as follows.

Coal Cleaning

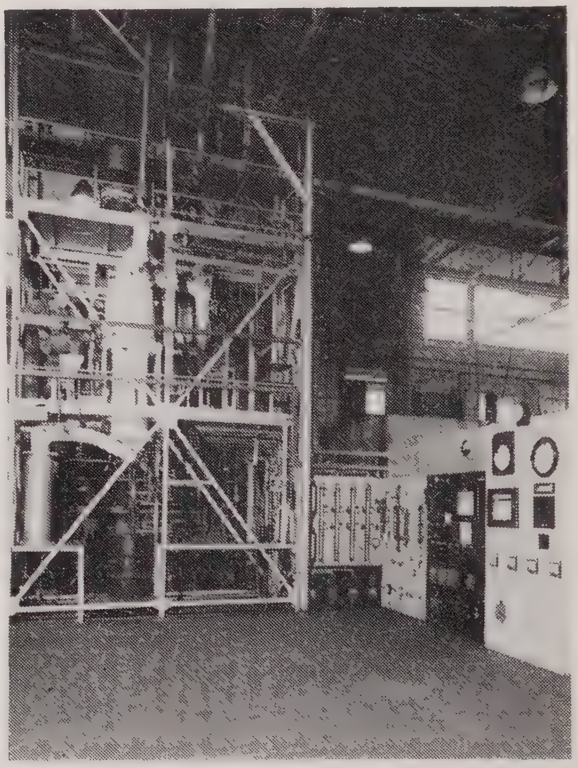
Apart from the future needs for clean coal for manufacture of domestic smokeless fuels, large and increasing quantities of coal dust are cleaned today by froth flotation. (The increase in the quantities of coal dust produced arises from a number of causes, among them a general decrease in quality and thickness of seams mined, and an increase in use of mechanical mining and loading). The use of this method of cleaning is still expanding, and the Board during 1955 brought into operation a further 19 plants for this purpose. Still more are under construction. The process, even though it is in large scale use, is as yet not fully understood. For example, the reasons for the variation in efficiency between coals of different type have not been elucidated. Research is therefore undertaken to clarify the exact mode of operation and the effects of different variables. One such variable is the efficient spreading of the oil on the coal surface, and an experimental machine, which in certain cases may give improved performance



Stoke Orchard

is now under test in one of the Divisions. The froth flotation process is by no means cheap to operate, and attempts are being made to devise machines which have a lower initial cost and lower maintenance and operating costs.

Attention is not confined to the cleaning of coal dust, and problems associated with large coal are also studied. It may happen in some seams that the coal is a mixture of two types, one hard with a dull surface, and the other softer but with a bright surface. Each of these components may have a preferred use, e.g. for railways and domestic use, and a method of separation would be useful. The normal methods of separation, depending on the density of the individual types, are frequently ineffective in such cases, and in any case it is preferable as far as possible to keep the coal dry. A method has been devised (and was demonstrated)



Experimental Fluid Bed for Devolatizing Coal Powder

in which a photoelectric cell differentiates between the diffuse reflection from one type of coal and the specular reflection from the other, and the response is used to operate a mechanical separator. A prototype machine operating on this principle is now being installed for test in one of the Divisions.

The desirability of keeping coal dry during cleaning has led to the examination of methods using other physical properties, such as electrical resistivity and dielectric capacity. Such investigations are still in the laboratory stage.

This Department provides a good example of the three levels of operation —laboratory, pilot plant, and trial at collieries.

Once having obtained the coal in a clean condition, two courses are open:

(*a*) The coal may be treated in its finely divided form to render it smokeless.

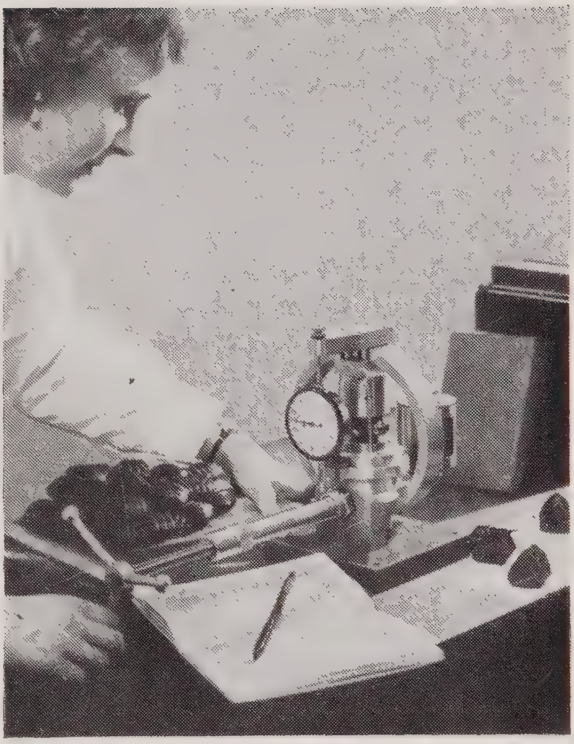
(*b*) The coal may be briquetted and then made smokeless.

Oxidation of High Rank Coals

Before dealing with processes for making the coal smokeless, a description was given of a process which makes a high quality domestic boiler fuel similar to Phurnacite. This process uses Kent coal of a type rather similar to that used in South Wales for Phurnacite. This coal, in natural lump form could probably be used as a smokeless fuel, since its volatile content falls below the limit of 20 per cent. put forward by the Beaver Committee. The coal is so friable, however, that a high proportion of coal dust is produced. Briquetting of this coal dust with pitch would make it smoky, and the problem was put to the Research Establishment of turning this coal into a high-class domestic boiler fuel.

The Phurnacite process, as used in South Wales, consists of mixing the coal dust with pitch, pressing the mixture into briquettes, and then carbonising these in ovens similar to coke ovens.

When such a process is attempted



Testing Briquettes for Strength

with Kent coals, great difficulties are encountered because the coal becomes plastic on heating, and the briquettes fuse into a solid mass. This fusing and sticking can be eliminated by a mild oxidation of the coal. To carry out this oxidation in an economical manner, they have adapted the technique of fluidization. This process permits very high rates of heat and oxygen transfer from the fluidizing gas to the solid.

This process has been taken through all the various stages to a scale of 1 ton per hour, and is now ready for full scale application when desired.

This 1 ton per hour oxidizer illustrates several important points. When working on a smaller scale, no reliable data could be obtained on the heat evolved or absorbed in the oxidation process, since the ratio of surface to volume is large in such small units. The larger pilot plant was therefore designed to have a preheater as well as an oxidation column. On the larger scale, it has been found that sufficient heat is evolved, when the oxidation reaction is carried out above a certain temperature, to make the use of a preheater unnecessary.

Indeed, the process can be made self-sustaining, so that the fluidizing gas can be cold air. These findings would, of course, represent a great simplification of the full scale plant and a corresponding reduction in cost, both capital and operating.

Another feature which this large oxidizer has demonstrated is the ease with which the whole process can be operated automatically. These are two items which would have been very expensive to discover on a full scale production plant.

The result of this work has been that the product from the oxidizer can now be briquetted and carbonized to produce a fuel equal in every respect to Phurnacite.

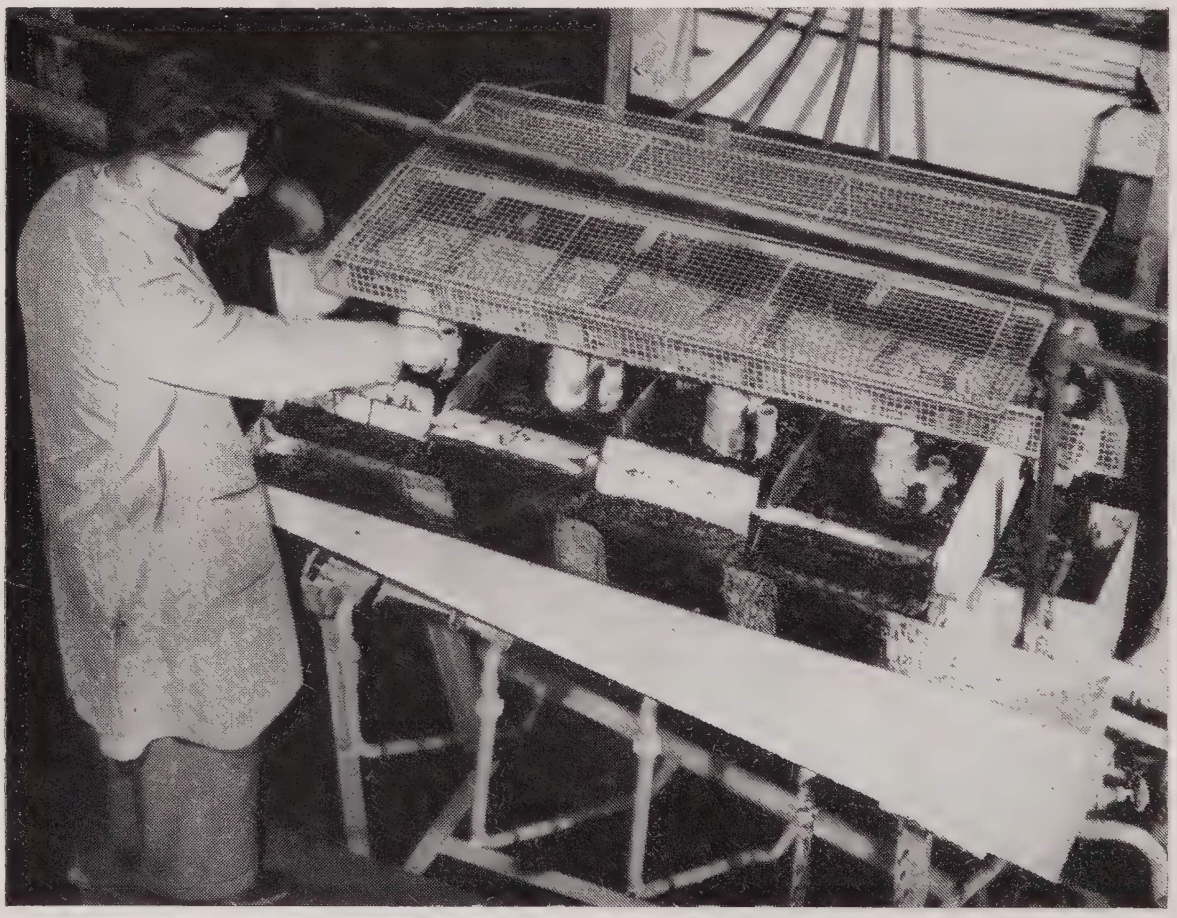
This work on oxidation has been supported by fundamental research into the nature of the chemical process taking place. As a result of this, it has been possible to fix optimum conditions for operation of the pilot plant.

Pretreatment by Devolatilization

In the previous section, a method was described in which the coal was put through a pretreatment stage before briquetting and carbonization. The process of oxidation however, is applicable mainly to coals with a low volatile content. A similar technique using much higher temperatures is being investigated to remove the smoke-forming components from the coal and to recover them as useful liquids and gases.

The work here has proceeded only to the small pilot plant stage. The two chief difficulties are to supply heat at the necessary high rate and to separate the dust from the oily by-products. Several methods of overcoming these difficulties are being examined, and encouraging progress is being made.

The conditions of heating in a fluidized carbonizer are entirely different from those in a conventional coke oven, and a feature of the



Test Equipment for Cleaning Coal by Froth Flotation

process is the very high yield of liquid by-products obtainable under certain conditions. This may amount to 30 gallons per ton or more.

The Briquetting of Coal

The emphasis in all the work described so far has been mainly on coal dust. To convert this to a useful domestic fuel, some method of re-forming the coal dust to lump form is essential. From the various processes described, the coal product will vary from coal to a semi-coke powder, and methods of briquetting these raw materials are being investigated. These methods of briquetting must not only produce a high quality fuel but must do so under the most economic conditions. For example, from both the oxidation and devolatilization processes the product will be delivered hot. To cool this to the usual briquetting temperatures and then to reheat the raw briquette to carbonizing temperature, would be wasteful of heat, and therefore methods of hot briquetting are being developed. This work has proceeded to the stage of a small continuous pilot plant, and work is now in progress to take this method to a larger scale. Quite apart from the saving in heat which can be achieved, a saving in binder requirements would result.

One further development in briquetting remains to be described. In the conventional methods, pitch as a binder is added as a powder. In this form, it is an unpleasant material and in hot weather involves much heavy manual labour in extracting it from the storage dumps. A process is being developed in which the pitch is used in liquid form.

The Carbonization of Briquettes

To produce smokeless fuels from briquettes made from raw coal and pitch, oxidized coal and pitch, and perhaps from char and binder, it is necessary to carbonize to remove the smoke-forming constituents. The normal process involves a lengthy period of heating, the heat from the oven walls having to be conducted through the mass of briquettes. A process is under development in which the heat is taken to each briquette simultaneously by particles of hot sand flowing over the briquettes. This process is still in its early stages of plant development, but the indications are that, if it can be taken to the large scale successfully, it should result in a considerable reduction in the time required for carbonization and, hence, in a saving in capital cost of carbonizing plant per ton of throughput.

It has been recorded how oxidation can control the swelling and sticking properties of some coals. These coals are the coals with low volatile content. There are large quantities of other coals, which are intermediate in behaviour between the true coking coals and the non-coking coals, to which the fluidized carbonization process could be applied only with difficulty. The coals in this range still show marked swelling and sticking properties, but the process of oxidation does not have the same effect as with the high rank coals. A new process has therefore been developed, in which small quantities of chemicals are added to produce the desired effect. This process has been taken to the production of tonnage quantities of a closed stove fuel of high quality.

In common with the other technical departments, fundamental research is carried out on the chemical and physical changes occurring during carbonization. The emphasis in this work is on those factors which affect the strength of metallurgical coke and has, as a main objective, a proper understanding of the blending of coals to extend the range of coals which can be used for this purpose. When dealing with a material so complex and so varied as coal, fundamental research is extremely difficult, but progress has been made which has already led to improvements in the quality of some cokes.

THE "ALKALI" REPORT

92nd Report on Alkali, &c., Works, for 1955. By the Chief Inspectors. (H.M. Stationery Office, 2s.).

Mr. W. A. Damon, who held with distinction the post of Chief Inspector of Alkali, &c., Works (for England and Wales) for twenty-six years, retired from his post in December last, and this report is the first to be signed by his successor, Dr. J. S. Carter. We extend our good wishes to Dr. Carter, and to the new Deputy Inspector, Dr. E. A. J. Mahler, and at the same time record a tribute to Mr. Damon for all he has done, in sound and practical work, for cleaner air. It is pleasant to learn that his services have not been lost to the Department, for he is carrying on in a full-time advisory capacity. With the expansion of the Inspectorate, and the new duties foreshadowed by the Clean Air Act, this is, as Dr. Carter says, "a most satisfactory arrangement."

Mr. E. A. Balfour Birse, Chief Inspector for Scotland, contributes the separate report relating to that country.

As usual, in reviewing these annual reports, it is most difficult to summarize, or to pick out the highlights, from what is itself a closely-written summary of a vast amount of solid technical work. The Chief Inspector and his Deputy, with seven district inspectors, are concerned with 921 registered works, which involve the operation of 1,794 separate processes. During the year 3,894 visits and inspections were made, over 500 of which were concerned with works not registered under the Act. There were also a further sixty visits to, or connected with, colliery spoilbanks.

An increased number of complaints about registered works are said to be due not to deteriorated conditions but to "a greater public awareness of the desirability for a cleaner air due to the publicity this has received." There were 21 occasions when escapes took place in excess of the statutory limits for registered processes, and 27 further infractions related to failure to use the "best practicable means." In every case formal notice led to suitable action being taken, so that there has been no occasion to institute proceedings.

The report refers to an increasing number of what may be called "area complaints"—that is, complaints against general conditions in a highly industrialized area rather than against emissions from individual works. Examples mentioned are the Trafford Park area and the Thames-side cement area. In another paragraph it is said that "the tendency to concentrate production at fewer and larger units continues."

There is clearly a connection between these two tendencies. Emissions from a single plant may be controlled within limits that are tolerable and do not give rise to complaint so long as that plant is isolated. But if it should be enlarged, or if there should be a concentration of similar plants in one area a time must come when the combined emissions provoke public reaction and complaint. To enforce still stricter regulations on each may be technically difficult or expensive, in which case the only remedy would be to limit in any area the number of plants, or their combined capacity or throughput. This has already been suggested in the case of pollution from sulphur-using plant in the Old Trafford district.

Sections of the report deal with such diverse problems as grit and dust from electricity generating stations, smoke and grit from coke ovens, metallurgical problems in variety, lime burning, stone crushing, fluorine emissions, and miscellaneous complaints that include

unpleasant smells. There is also a discussion on burning colliery spoil-banks—duly translated in Mr. Birse's report in the Scottish " bings." For the benefit of transatlantic readers this just means gob piles.

FUEL RESEARCH PROGRESS

Fuel Research, 1955. Report of the Fuel Research Board, with the Report of the Director of Fuel Research. H.M.S.O., 4s. 0d.

It would be appropriate to discuss nearly the whole of this report in *Smokeless Air*, for in one way or another most of the work being done at the Fuel Research Station has a direct bearing either on the study of air pollution or the way to prevent it.

The report discusses the scheme whereby regular measurements of air pollution are made by local authorities and other bodies, in co-operation with the Department. The number of instruments in use increased during 1955 by nearly 30 per cent. to a total of 1,981, and the number of co-operating bodies by 8 per cent. to a total of 218. During the winter of 1955-56 the scheme for obtaining frequent measurements of the concentrations of pollutants in periods of severe and prolonged fog was put into action in London, Sheffield, Salford and Stretford on three occasions during the closing weeks of the year when dense fog was forecast. Some hundreds of measurements were made and the results are being analysed together with the data obtained subsequently in these and other areas.

A large amount of experimental work has been carried out, says the report, to provide data on the measurement of smoke for committees of the British Standards Institution which were formed in accordance with suggestions made in the Beaver Report, which had defined " dark smoke " as smoke with a density equivalent to or greater than No. 2 on the Ringelmann chart. Although the apparent darkness of smoke is influenced by atmospheric conditions and by the colour and size of the smoke particles, it appeared from earlier work on boilers at the Fuel Research Station that there was some degree of correlation between the Ringelmann chart reading and the optical density of the smoke as measured in the flue or chimney. Experiments have shown that for smoke of the same optical density the variation in the readings taken with a Ringelmann chart under different atmospheric conditions was not greater than plus or minus $\frac{3}{4}$ of a Ringelmann number. It is hoped that further tests now in progress will enable a manufacturer to supply an optical instrument to give a fixed deflection when smoke of Ringelmann No. 2 density is made at a particular plant, without special calibration on the site.

Domestic Heating

Work on different aspects of domestic heating and fuel usage is discussed in the report. There is, for instance, research on the production of freely-burning domestic coke using coals of lower rank than those normally used in gasworks practice, and continuing work on the estimation of room-heating efficiency in the Calorimeter building. For open fires—inset or freestanding—or openable stoves used with the fires open, at the full rate of burning, the efficiency when burning coal is only three-quarters of that obtained with coke. The loss in the case of coal is due mainly to the escape of unburned gases up the chimney. Reducing the rate of burning increases the efficiency with both fuels, but the increase is greater for coal; similar increases in efficiency can be obtained by reducing the rate of flow of air in the chimney by introducing a chimney throat restrictor.

(*Concluded, page 38*)

" *Do you feel any better since you gave up smoking?* "

DIVISIONAL NEWS

The Annual General Meeting of the **North Western Division** was held at Oldham on the 31st May. The meeting was addressed by the Society's Director, Mr. Arnold Marsh, who spoke on the implications of the Clean Air Bill (as it then was). Mr. Marsh said that the Bill could have contained stronger measures, but continued by stressing that its success would depend upon the vigour with which it was applied by local authorities. He pointed out that the Society could help local authorities in many ways, and said "The most important period of the Society's life is just about beginning."

Mr. S. N. Duguid, the Deputy Chairman of the Divisional Council, said that it was no use to talk about smoke abatement until some alternative was found to coal for domestic use. He said that what was needed was co-ordination between fuel industries to invent a fuel that would be more attractive to consumers than coal. He complained that when the Society advocated the use of coke, their efforts were rebuffed by the increases in price.

Other members, who also concentrated their discussion on the domestic fuel problem, complained of resistance to coke by the ordinary housewife (on the ground that it was harmful to health). Alderman Goulden of Salford also said that there was a problem of expense in housing estates where the use of coke was enforced. Dr. J. S. G. Burnett, Medical Officer of Preston and Deputy Chairman of the Society's National Executive Council, said that smokeless zones would not be fully effective until slums had been cleared.

The **Yorkshire Division** met on 29th May at Wakefield Town Hall and again on 24th July at Leeds Public Health Department. At the Wakefield meeting an address was given by Dr. C. G. K. Thompson, Medical Officer of Wakefield. In the course of his talk Dr. Thompson expressed concern about the effects of miners' concessionary coal on the smoke problem in the city. The "home coal," he said, encouraged miners and their families to burn coal carelessly and without regard for efficiency, and as a result there was a great deal of smoke from their chimneys. Wakefield's smoke problem, said Dr. Thompson, was made greater by the fact that it was surrounded by pits on all four sides and only by very close and friendly co-operation had they been able to reduce a great deal the effect of smoke and fumes from the working of these pits.

After emphasizing the need for increased supplies of smokeless fuel from the coal and gas industries, Dr. Thompson went on to speak of the lessening of industrial smoke in the city in recent years. He said this was partly due to the National Industrial Fuel Efficiency Service, by whose help they had been able to get rid of a considerable amount of smoke, and save consumers a great deal of money. He also said he would like to see a more general use in boilerhouses of instruments such as smoke density meters and CO_2 recorders.

Delegates were welcomed to the meeting by Coun. L. Boston, chairman of Wakefield Health Committee. The meeting approved the recommendation of the Executive Council that the name of the Society should be changed to National Clean Air Society.

The second meeting was held in the Public Health Department, Vicar Lane, Leeds, where Mr. L. E. Nichols, N.I.F.E.S. Area Engineer, gave a talk on the work of the Service, followed by one of N.I.F.E.S.' instructional films for stokers and the film of

Pittsburgh's smoke abatement which was recently shown on television. Mr. Nichols said in the course of his address that for every pound that industry spent on N.I.F.E.S., it saved five tons of coal, and pointed out that this increase in fuel efficiency also meant a considerable reduction in smoke emission. He said that it was part of N.I.F.E.S.' task to produce a balance sheet for industrial plants showing on the one hand the amount of heat produced, and on the other, the amount used. The Service could then go ahead in advising and recommending ways in which fuel efficiency might be improved.

The Annual General Meeting and Conference of the **Scottish Division** was held at Rothesay on the 31st May and the 1st June. After the Annual Business Meeting on the first morning, the Provost of Rothesay welcomed the delegates. His speech was followed by two papers on "Contemporary Space Heating" by Mr. J. W. Moule, of the South of Scotland Electricity Board, and Mr. D. E. Moore, of the Scottish Gas Board.

Mr. Moule began by describing the ways in which heat was lost from the human body, and made the point that heating must be supplied in similar ways and in similar proportions if full comfort conditions were to be obtained. He then went on to describe the various forms of electrical heating and their applications, including the off-peak system of floor warming as described in his paper to the Society's Bournemouth Conference. He also pointed out the advantages of off-peak usage of electricity when nuclear power generation becomes more general, and outlined some of the costs of various forms of electric heating.

Mr. Moore spoke of the advantages to be gained by using gas to heat large blocks of flats or offices. He pointed out that many people who were out all day resented having to pay the same rates for central heating as everyone else. The provision of separate gas heating would meet this difficulty. In blocks of offices, gas appliances in each room offered the possibility of more variation according to requirements, and would be readily available to meet a cold snap out of season. Where boilers were used, gas-firing would save labour and adjustments could be made without trouble or mess.

In certain cases, such as churches, it was an advantage to use radiant heaters, as they gave very rapid heating, which was particularly useful in buildings which were only used intermittently.

They could also prove very useful in factories, Mr. Moore claimed, especially where some people were working actively and others were seated at tables or machines. The general temperature could be raised to a level to suit the former, while the additional warmth needed by the latter could be provided by radiant heaters directed towards them.

While speaking of the various forms of gas fires and heaters, Mr. Moore claimed that one of the main virtues of gas fires in bedrooms was the ventilating effect, since all gas fires in such rooms must be connected to a flue or chimney. He also mentioned that in cases where a solid fuel fire heated water by means of a back boiler, the latter could be used in summer without inconvenience by means of a gas fired heater which connected to the point normally used for a gas poker.

After lunch on Thursday the delegates enjoyed an excursion to local places of interest, and on the following morning heard two papers: by Mr. D. W. Slimming and Mr. H. S. Hughes. Mr. Slimming's paper was devoted to the Measurement of Air Pollution, in which he outlined the history of air pollution measurement, the chief instruments and methods used, and the advantages to be gained from taking measurements. Concerning the advantages, he pointed out that they would tell a local authority whether the pollution was produced locally or not, and could be

used as evidence when approaching other authorities or industrialists, as well as to convince public opinion.

Mr. Hughes spoke on " Gas Coke as a Smokeless Domestic Fuel." He compared the efficiency of the various types of solid fuel appliances when burning coal and coke, and stated that as a general rule coke was about one third more efficient than coal. However, the Gas Council's own information suggested that in actual usage the figure was more like a half.

Mr. Hughes referred to the storage space needed and techniques required to obtain the best results. He then went on to discuss the quality and availability of coke. He said that integration of the gas industry following nationalization had helped by enabling smaller undertakings to supply coke of a proper size, and movement of coke between towns or local undertakings was possible. This was of course expensive, but authorized smokeless zones were of such importance nationally that the gas industry had stated that all means would be taken to ensure adequate supplies of coke for such areas.

The afternoon session was devoted to a " Brains Trust " at which some pertinent questions were asked, thus providing a lively ending to a very successful Conference.

The Annual General Meeting of the **East Midlands Division** was held in the Palmerston Room, in the Chapel Court of St. John's College, Cambridge, on 19th July. The Right Worshipful the Mayor of Cambridge (Coun. C. Elliot Ridgeon, M.A., J.P.) welcomed the delegates and spoke of his interest in atmospheric pollution. The Chairman of the Division, Ald. S. Cooper, expressed the thanks of the Society to His Worship the Mayor for attending the meeting and giving a welcome. During the meeting Coun. Mrs. Ellen E. Bostock was appointed Chairman and Mr. G. E. Chamberlain was appointed Deputy Chairman for the year 1956/57.

The meeting was addressed by Mr. D. W. Bottom, Chief Sanitary Inspector of Cambridge, and Mr. Humphrey L. Warren. Mr. Bottom spoke on " Clean Air Legislation and Local Authorities." He briefly outlined the main points of the Clean Air Act, and said it was running true to the pattern of English public health law. " It is a compromise and I hope it is based on facts and realities as well as on doctrine," he said. In regard to fireplaces, he said that these would have to be adapted or renewed, and this was an enormous problem which would have to be tackled sensibly and with discretion. There would be much work for local authorities and their sanitary inspectors.

On the local aspect of the problem Mr. Bottom said that in Cambridge they had historic and beautiful buildings and they were anxious to discover if a change to oil-firing would have an effect on them, different from that of coal or coke firing. It was a very important point for them.

In his address Mr. Warren, managing director of Coote and Warren Ltd., of Cambridge, spoke on " Solid Fuel Supplies." He said that it was upon solid fuel supplies that the speed of implementing the Act would depend. The policy decision to permit smokeless fuels only without Ministerial permission was made because it was very difficult to burn bituminous coal smokelessly at low rates of combustion. But they could reasonably foresee (even if it was not already available), a furnace that would burn coal smokelessly at a minimum rate of about 1½ lb. per hour. It could not be used as a direct replacement to the average house as now heated, but it would provide a good standard of heating in many houses at a little more cost than the " half-heating " we now accepted. If the present legislation led to this kind of development, the amount of smokeless fuel we should need would be reduced, the clean air campaign would make far faster progress, and houses would be better heated.

Mr. Warren said that the speed with which zones could be established would depend on the rate at which the output of high quality coke could be increased. He said that he used the word " increased " quite deliberately, for while a certain amount of substitution of oil for coke would release some coke, it must not be forgotten that there was a continually expanding demand for coke in all areas. It would be folly to prevent people who wanted to burn coke without compulsion and without grants from doing so, merely because they did not live in a smoke control area. He wondered whether regional gas boards would first ensure that another region, to whom they had been sending coke, had found a suitable substitute, before switching their supplies to a smokeless area.

Discussions on the papers and questions were replied to by the speakers. At the conclusion of the discussion, Mr. T. Henry Turner moved a vote of thanks to the speakers and all who had taken part in the organization of the meeting. Lunch was served at St. John's College and during the afternoon, parties visited the University Dept. of Engineering, the mechanized distribution centre of Messrs. Austin Beales & Co. Ltd., and the works of the Cambridge Instrument Co.

The annual meeting of the **North East Division** was held in Newcastle on 27th July. The meeting heard with regret of the retirement of Mr. W. Gray from his post as Chief Sanitary Inspector, Newcastle-upon-Tyne, and of his decision not to seek re-election as Hon. Treasurer of the Division. A word of tribute should be paid to Mr. Gray, as well as to Mr. G. W. Tate, for contending so patiently and cheerfully with the peculiar difficulties that have for some years beset the Division. Mr. Tate was elected as Hon. Treasurer in place of Mr. Gray, and Mr. J. S. Edwards, Chief Sanitary Inspector, South Shields, was elected as the new Hon. Secretary.

Alderman J. Chapman, who had been Chairman since the Divisional Council was formed, was unable to be present because of indisposition, and Councillor J. Brown of Middlesbrough, representing the Tees-side Advisory Council for Smoke Abatement, was elected as Chairman. A new Executive Committee was also elected.

During the meeting, and again at a special meeting for local authorities held later, the question was discussed of organization to overcome the difficulties that the Division has encountered in holding meetings for attendance at which local authority members would be enabled to receive expenses. It was agreed to proceed and the local authority members of the Society's Divisional Executive were elected to act as a provisional committee for the purpose of preparing a scheme and submitting it to a later meeting. It was pointed out that under the Clean Air Act (section 31) it would now be possible to set up joint advisory committees consisting of local authority and *other* members.

Fuel Research Progress

—concluded

It has previously been reported that with an open fire there is a reduction in the amount of smoke that emerges from the top of the chimney for a given weight of coal burnt when a throat restrictor is used to cut down the rate of flow of air and flue gas in the chimney. Experiments have now shown that the amount of soot deposited within the chimney is also reduced.

The loss of efficiency in openable stoves when operated with the doors closed, due to air leaks through badly-fitting doors, has been further investigated. This loss is found to be significant and it is concluded that a leakage check should be included as a routine part of the production-line inspection of stoves.

GAS ENGINEERS IN CONFERENCE

Three of the papers read at the annual general meeting of the Institution of Gas Engineers in London on 29th May to 1st June, have a special interest in relation to the clean air drive. One, by J. Burns and L. J. Clark, was on *Liquid Methane*, in which were discussed the prospects and technical problems of bringing to this country and using some of the supplies of natural gas that exist throughout the world. Experts estimate that the reserves of natural gas are at least as great as those of oil. So far, this source of energy has been only superficially tapped. In the Middle East alone it is estimated that more natural gas from oil wells is being flared to waste than would be required for the total needs of the British gas industry. It is from here, and from Venezuela and Mexico that this country is most likely to obtain supplies of natural gas. The main problem to be solved is that of trans-ocean transportation. The gas can be liquefied by cooling to a low temperature, when it occupies only 1/600th of its volume in the gaseous state. So far, however, no ships have been built that are capable of crossing oceans and also carrying fluids at sub-zero temperatures. Liquid methane tankers are likely to cost twice as much as conventional oil tankers, and eventually it would be advantageous to use tankers of up to 35,000 tons.

Another paper of interest was on *Domestic Utilization of Gas and Coke*, by L. W. Andrew. The technical implications of our national fuel policy are considered and special importance is attached to the field tests carried out at Abbot's Langley by the D.S.I.R. The paper contains a great deal of valuable data. Following on, so to speak, from this was a paper on *Domestic Coke Preparation at Kensal Green*, by G. F. I. Roberts and R. S. Rodick. In view of the importance of raising the quality and public acceptability of coke, especially in the smoke control areas that are to come, this practical contribution is most useful. The North Thames Gas Board's method of systematically analysing consumer complaints is described. A chart showing the decline in complaints—for all reasons—is most encouraging, as is the statement that " complaints with regard to grading have been cut down and those concerning moisture in coke have been virtually eliminated.

Chicago-Style Smog

The following is reprinted from the February 10th edition of the *Chicago Tribune:*

" Are you getting your full share of the dirt that filters down on Chicago every day? If not, you should complain. The latest statistics show that each inhabitant of Chicago is entitled to receive 100 pounds of dirt each year in the air he breathes. The Chicagoan, as everyone knows, is not the boastful type. When he goes elsewhere, he notes at once that the air is thin and insipid, but scrupulously avoids mentioning it for fear of wounding the feelings of others."

" Chicago air is for he-men. In fact, he-men are about the only ones who could inhale it and survive. It has a heartiness about it, a body and a flavour, a richness, even a chewiness. It contains corrosive acids and dangerous alkalies. Few other cities can make this claim."

Effect of Fumes on Cathedral

Speaking at a garden party at Daventry to raise funds for the restoration of Peterborough Cathedral, the Archdeacon of Northampton, the Ven. C. J. Grimes, said that the sulphurous fumes of Peterborough had had a terrible effect on the stonework of the cathedral. The cathedral was laid down thirteen centuries ago, but such were the ravages of the fumes that unless something was done an irreparable loss would follow. The target for the restoration was £100,000

DISPOSAL OF COLLIERY WASTES

By

R. Lessing

From a Paper read at a recent conference of the Society of Chemical Industry

AN example of the problems which were created by the achievements of the industrial revolution in the nineteenth century and left unsolved is that of colliery spoil heaps. Now in the midst of another industrial revolution it behoves us to exercise the foresight which then was lacking and which the new conditions of life demand. We must use the technical means now at our command to eradicate the evil, or at any rate prevent it from spreading. Travelling through coal mining districts must fill any lover of the countryside with disgust at the mere sight of the dumps of waste material and with pity for those who are compelled to live under their shadows.

Nature of the material and its origin

In mining operations it cannot be avoided that the " dirt " layers within and close to the seam are extracted along with the coal. Where selection can be conveniently exercised at the coal face, roof shales and " dirt " veins may be left underground, but much of this material is of necessity brought to the surface. Indeed, with mechanized coal-getting and loading such discrimination becomes impossible and the amount of non-coaly material raised is steadily increasing. In the preparation of coal for utilization, whether by hand-picking or with mechanical separation by wet or dry methods, the unsaleable refuse is discarded and dumped as waste. These accumulations of refuse, termed spoil or refuse heaps, tips, banks, piles or, in Scotland, bings, form a disfiguring feature of the mining districts. Their total number in Great Britain is difficult to ascertain, but amounts to several thousands. Some of these heaps are spontaneously ignited and combustion is maintained in them sometimes over periods of many years, resulting in serious pollution of the air, fouling of watercourses and causing other nuisances in the vicinity and occasionally at quite distant points.

The refuse deposited on spoil heaps differs widely in the size of lumps and particles and in their chemical composition and physical structure. The debris made in " driving " or tunnelling operations consists mainly of rock and is substantially incombustible. The material discarded in the course of coal preparation may be either pieces of coal intergrown with pyrites or shale of more or less carbonaceous character. Except in the relatively few modern coal preparation plants which are designed for, but not necessarily operated at, a high efficiency of separation, most washeries do not effect a sharp cut between coal and the impurities. Consequently " dirt " is left in the coal and some quite clean coal is discarded. Whilst all carbonaceous shales have an appreciable calorific value, this is increased by the proportion of good coal left in the washery refuse.

These various factors make it difficult to give average values for the heat content of colliery spoil, particularly in cases where " sinking " and " tunnelling " dirt is indiscriminately mixed with washery refuse. The calorific value generally lies within a range of 2,500–5,000 B.Th.U./lb.

Burning spoil heaps

By reason of colliery spoil heaps being composed of or containing combustible matter, they are liable to be set on fire. In 1955, 261 heaps were found to be burning in England

and Scotland, producing varying amounts of smoke or fumes.

The most common cause of the burning of colliery spoil heaps is spontaneous ignition. It will be useful for a better understanding of this phenomenon to outline briefly the sequence of events and the principles which govern the initiation of combustion of organic matter, particularly coal, either by spontaneous ignition or on the application of external heating.

The fundamental chemical reaction by which heating of combustible matter is initiated, is the addition of oxygen to the fuel or other organic substance. The addition of atmospheric oxygen to the coal substance by way of adsorption or formation of loose carbon-oxygen compounds, with the possible intervention of a peroxide reaction, is exothermic. The liability to oxidation at ordinary temperature varies to a certain extent with the kind of material and in the case of coal with its rank. In general, coals already highly oxygenated and those containing much inherent moisture are most readily oxidized, whilst those of low oxygen and high carbon content are more resistant to oxidation.

A rise of temperature facilitates the rate of oxidation. If the heat initially generated is not dissipated, but retained in the mass, the oxidizing and heating effects become cumulative and the temperature of the mass rises more rapidly. Under conditions where the balance between the generation and dissipation of heat is in favour of the former, a critical point is ultimately reached where the material becomes ignited and will continue to burn if air has sufficient access to it.

The conditions under which heat generated by oxidation is either dissipated or retained, are governed by the ease with which oxygen can gain access to the surfaces of the combustible material. This in its turn depends upon the size of pieces and particles, their grading and location in the mass relative to each other.

Grading is important in the oxidation and self-heating of coals or other combustible materials because it determines the proportion of the volume of voids and their disposition in a given mass. If the bulk consists of small particles, the voids are narrow, the mass is compacted and offers resistance to the passage of air currents. If the mass is a mixture of large, medium and small sizes, the smaller particles lodge in, and block the passages between, the larger pieces and an intermediate condition will result.

The facility with which air passes through the mass determines the rate at which heat generated by oxidation is carried away by an ample flow of air adequate to cool the material. With small particles and blocked passages the air remains more or less stagnant and the heat generated by the oxygen absorbed from it is retained in the mass, but when the available oxygen is used up the heating process comes to a stop.

A somewhat modified set of conditions is set up when a porous mass of large pieces and a dense mass of small particles are not mixed, but are located adjoining each other. In such a case the relatively large volume of air in the porous mass will generate heat which cannot be carried off in the direction of the dense mass, as this forms an impervious barrier. The heated part of such a combined structure may form a hot spot and if subsequently it is vented to the atmosphere by one means or another the hot spot may actually break into flame.

The foregoing considerations apply to self-heating of organic materials in contact with air at ordinary temperature. Self-heating does not necessarily imply spontaneous combustion, but is a preliminary stage which may eventually lead to it. For combustion to occur, whether spontaneously or initiated by external agents, two main conditions must be fulfilled.

(1) The material must be heated to the ignition point, which is the temperature specific for each material below which spontaneous ignition cannot occur, and

(2) Over or through the material heated up to or above this critical temperature, air must be passed at the proper rate to cause ignition and maintain combustion.

The distinction between preliminary heating, ignition and combustion must be borne in mind for a clear understanding of the problem involved.

The products of the reactions occurring within a spoil heap on fire comprise carbon dioxide, carbon monoxide, hydro-carbons, sulphur dioxide and water vapour, diluted with varying proportions of excess air and nitrogen. In the early stages of spontaneous heating or of heating caused by convection from adjacent hot spots, a mild thermal decomposition of the coal substance takes place, with the formation of volatile compounds such as in underground gob-fires are indicated by " gob-stink."

The incomplete combustion which must occur in certain parts of the spoil heap in which the air currents are restricted results in some carbon monoxide being present.

The oxidation of pyrites and marcasite in the material and that of the organic sulphur in the coal substance yields sulphur dioxide from points of complete combustion. Where the mass is undergoing thermal decomposition with insufficient air, hydrogen sulphide is given off. Sulphur oxides and hydrogen sulphide may emanate from the same heap, so that together with hydrocarbon vapours a complex mixture of air pollutants results. By the action of rain or water spraying applied to the heaps, some of the sulphur-bearing material on weathering yields soluble sulphates which are washed out from the heap as an acid effluent, sometimes causing serious pollution of streams and rivers.

The reaction of oxygen with pyrites has a two-fold effect. Being strongly exothermic it causes a rapid temperature rise, but it also is accompanied by a shattering effect whereby fresh surfaces amenable to further oxidation are exposed.

The mechanism of oxidation has been studied by many workers with various kinds of coal as their material. The paucity of corresponding researches into the behaviour of packs of colliery spoil must be explained by the difficulty of drawing representative samples of a material so heterogeneous in its physical form, mechanical structure and chemical composition, and the widely varying atmospheric conditions to which it is exposed.

If the ever-increasing need for colliery refuse disposal is to be met by dumping it on the surface of the land, research must be conducted with reasonable tonnages of material, as has been done for the study of underground gob-fires.

Construction of spoil heaps

The guiding principle in the building up of colliery refuse heaps should be the prevention of ingress of air into the mass. In the past little attention has been given to this precept. Heaps " grew " without any purposeful application of any system. The deciding factors were availability of land close to the pit or washery and cheap transport to the point of tipping. In many cases rock, belt pickings, washery refuse and slurry were not separated. The lack of uniformity due to such indiscriminate dumping makes control of the air currents within the mass practically impossible.

Another difficulty arises from the wide range of particle sizes, even of the same type of refuse. When tipping such materials from a single discharge point of an aerial ropeway, fines tend to remain in the centre and on top of the cone formed, whilst the larger lumps roll down the outside and broaden the base. When tipping proceeds along a line either from the air or from trucks or conveyors a ridged heap or embankment of similar cross-section is formed.

It is a common experience that fires, whether caused by spontaneous ignition or externally applied heat, start in the outer " sheath " of lumpy material. The open texture affords a

A Burning Spoilbank in the North East

ready passage to air, and once the ignition temperature is reached at some point, combustion is induced by the " flue " and " chimney " effect of the voids, until it reaches a dense barrier of smalls which impedes further progress. This does not mean a complete stoppage, for the pack is never hermetically sealed, but a slowing down of the " underground " fire. Whilst combustion may be propagated for a certain distance in layers of open texture in days or weeks, it may take months or years to penetrate the dense core.

Owing to the irregular size and disposition of the lumps and particles, the course taken by a spoil heap fire can never be predicted. Conditions are often complicated by " spurs " or " fingers " reaching out from the main body of the heap, each with its own discontinuous texture, aggravated when the ravines between spurs are filled up.

Disturbances within the mass entail a risk of fire spreading. These may be caused by the collapse of burned out cavities, cracks and fissures made by settlement or water erosion.

Wood, paper, sacking, vegetable matter or any other combustibles left in the heap may initiate self-heating and involve serious risks.

There are many instances of outside agencies having started spoilbank fires. Household rubbish, itself liable to spontaneous heating, or hot boiler ashes when tipped against heaps have often started fires. In one case investigated by the author, house refuse was found to be the most likely cause of initiating a fire in an old dump that had been cold for many years. In spite of all practicable measures taken to control or put out the fire, it proceeded unchecked into, and caused the collapse of, a main road the foundations of which had been built of similar colliery spoil thirty years before.

Braziers used in cold weather by workers on spoil heaps have been found responsible for fires.

An abandoned spoilbank in Scotland was set on fire with serious consequences by the thoughtless lighting of a Guy Fawkes bonfire on its top.

Many cases have been reported of fires having been induced, some with fatal results, by children playing on spoil heaps or adults picking coal from them, and thereby disturbing the mass and admitting air to hot spots.

Prevention of fires

From the foregoing it must be concluded that no method exists for the certain and absolute prevention of fires in pit heaps. The most one can hope for is to minimize the risk by using sound methods of constructing

new heaps. There are no positive means by which existing heaps of unknown or doubtful texture can be made safe at reasonable expense.

The rules to be observed in building new heaps are directed to the avoidance of air currents within the mass, or, since this is a counsel of perfection, their reduction to the possible minimum. This can only be achieved by avoiding segregation of sizes and by compaction of relatively shallow layers. If layers are allowed to be too thick (more than 1 or 2 feet), only the crust will be compacted and the remainder will be left in the loose, " voided " condition.

Even compaction does not provide a guarantee, unless it is also applied to the slopes of the heap. This can be done with inclined rollers but not if the slopes are too steep.

As compaction does not result in impermeability unless it is preceded or accompanied by crushing, sealing materials such as clay, ground limestone, fly ash or stone dust, dry or in the form of slurry, should be interposed between layers. This not only means additional expense, but may be prohibitive if such materials are not available in the neighbourhood in sufficient quantity.

Before laying down a heap, the ground should be cleared of all vegetation to reduce the risk of spontaneous ignition from that source.

Where the spoil comprises materials of a wide range of sizes it may be desirable to keep these separate and build up individual heaps of each. The larger size will then form a mass so well ventilated that air passes through it at a rate fast enough to dissipate any heat engendered by initial oxidation. The smaller sizes, on the other hand, will form a dense mass, more amenable to compaction. Such individual heaps must be sited at an adequate distance from each other to prevent them becoming contiguous in the course of their expansion.

Extinction of fires

The procedures for preventing fires outlined so far relate to the building-up of new heaps. No hard-and-fast rules can be applied to the extinction of fires in existing heaps. Most of these have been put up indiscriminately over long periods and their internal structure is unknown. In many heaps some parts are on fire, others are smouldering, dormant or completely burned out.

The methods of extinction are therefore largely dictated by local conditions. The conventional measures taken are: digging out affected portions, spraying or flushing with water, levelling and compacting by bulldozing, crushing, blanketing with inert material in slurry form.

The location, extent and progress of heating within the heap is ascertained by driving rods or tubes containing thermometers into the interior to measure the rate of temperature rise. These observations give some guidance for the selection of the methods to be used. Much depends on the availability and cost of man-power, water or sealing materials and not least of space.

The use of water calls for special mention. Flushing by hosepipe may saturate the heap if water is abundant, but it has the disadvantage of disturbing the heap by channelling and of polluting nearby streams. Spraying water is the more common practice, but it may have an adverse effect if applied too sparingly or intermittently. It may then induce increased heating or an actual flare-up. The same effect is frequently observed in damp or rainy weather. Changes in the barometric pressure and saturation of the air cause the heap to " breathe." It is conceivable that this susceptibility to moisture may be due to the watergas reaction of hot spots with water vapour, resulting in the propagation of ignition by burning gas.

All these expedients must be regarded as palliatives affording no more than partial or temporary improvement. Proof of this is furnished by the meagre success achieved by the treatment of many colliery spoil heaps in Britain. From 1932

onwards the Alkali Inspectors have visited many heaps in an advisory capacity, and without statutory obligation, to secure the abatement of smoke and offensive fumes for reasons of public health. With the outbreak of war and the enforcement of blackout conditions, this work was regarded of such urgency that the inspectors were instructed to drop their statutory routine duties and to concentrate their energies on the elimination of glare from spoilbanks.

For the purpose of recording progress, spoilbanks were classified according to their showing no signs of fire, slight signs but no glare, signs of fire with danger of exhibiting glare, and showing glare. The notation of this grouping was modified after the war to:

Class A—No smoke or fume.
Class B—Slight smoke or fume.
Class C—Much smoke or fume.

To illustrate the subsequent development by wartime experience, the results from nearly 700 spoilbanks inspected annually during the last 13 years have been tabulated.

The tabulation shows that after the substantial extinction under wartime compulsion of nearly all fires producing glare, a general deterioration set in, as shown below:

		Spoilbanks inspected	*Smoke or fume*
1946	..	657	235
1955	..	687	261

Not only has the number of spoilbanks which called for inspection increased, but the proportion of those emitting smoke or fumes has risen from 36 to 38 per cent. Further, it does not mean that the remaining heaps (Class A) are " dead." Many of them are almost certainly on fire internally, but show no visible sign of it by smoke or fume, due to the fire being kept under control.

Sterilization of land

The Alkali Inspectors visit only those spoilbanks of which they receive complaints from local authorities. Those recorded represent only part of the whole. It is difficult to ascertain the total number but, including many small heaps and those abandoned, they run into thousands. These heaps occupy land which mostly was at one time used for agriculture. From a rough preliminary survey it is estimated that the area in England and Wales sterilized by active colliery tips is at least 15,000 acres. The corresponding figures for all Scottish counties are not yet available, but are not likely to be lower for the corresponding coal output.

It is almost impossible to reclaim for economic uses land already occupied by pit heaps, but much can be done by levelling, grass sowing and tree planting towards improving amenities and landscape. Some County Planning authorities are active in this direction.

The more pressing problem is the avoidance of accretion to the existing spoil heaps. The quantity of " dirt " discarded from the material extracted from the mines is approaching 40 million tons a year. With increasing mechanization, dirtier seams and horizon mining the rate will tend to accelerate. The space required to accommodate this tonnage when heaped to a reasonable height is not less than 750 acres. Local authorities are demanding lower and flattened banks to prevent spontaneous ignition. The annual requirements for surface area may therefore extend to more than 1,000 acres per annum. The country can ill afford such encroachment on land sorely needed for agriculture and housing, and vigorous steps must be taken to inhibit the advance of dereliction.

Mining subsidence

The spoliation of land and air pollution are not the only disadvantages of heaping up colliery discard on the surface. On extracting the material from the mine along with the saleable coal a cavity of corresponding volume is formed that contributes to the risk

of subsidence of the overlying strata with all its dire consequences. Indeed, the hollowing-out of the earth's crust coupled with piling up mountains on top will gradually modify the surface geology of the mining districts.

The task ahead

The objectives of tackling the problem fall under four heads:

1. To limit the danger and nuisance of burning pit heaps.
2. To prevent wastage of the fuel value of the material.
3. To minimize damage by subsidence.
4. To arrest further sterilization of land.

1. *Abatement of air pollution*

The growing realization of the social and economic consequences of air pollution has of late resulted in steadily increasing the number and pressure of complaints in the affected districts. The Committee on Air Pollution (Beaver Committee) recommended a legislative provision which requires persons depositing coal mine refuse to use the best practicable means for effectively preventing spontaneous heating and the discharge of fumes. The Clean Air Bill which has reached the Committee stage in the House of Commons includes a clause to give effect to this recommendation, declaring that a person failing to comply be guilty of an offence.

The question still remains whether the best practicable means are good enough to counter the risks inherent in the existing heaps of unknown structure and composition. The provision of the Bill, when enacted, calls for entirely novel concepts of the methods of disposal of colliery refuse accruing in the future.

2. *Recovery of fuel value*

The fuel value of mine refuse differs widely according to the degree of carbon content of the shale, the dirt in the seams worked, the proportion of rock included and the design of washeries and separating efficiency of preparation processes. The incontrovertible fact remains that many heaps are on fire and most others are liable to burn unless certain precautions are taken. The potential heat value of refuse accruing at a rate of 40 million tons a year, when based on the low figure of 2,500 B.Th.U. per lb., will be equivalent to that of nearly 10 million tons of "saleable" coal. This refers to the total national output. Obviously full recovery cannot be contemplated in the near future, but can the country afford to lose even a portion of this total, considering the limitations of coal production and the steadily increasing energy requirements?

The utilization of colliery refuse for heat and power production should be regarded as an important factor in the fuel policy of the nation, and steps should be taken forthwith to install plant for that purpose at collieries where conditions are favourable. Clearly, conventional boiler furnaces cannot be used for combustion of fuel containing 60 per cent. or more of ash. The task of the engineer to develop and perfect the equipment required will be lightened by the knowledge that the feasibility of the proposition has already been demonstrated. In connection with the first gravity separation plant built in this country (at Yniscedwyn, S. Wales), the refuse obtained was used for steam raising in a specially designed installation which gave a fair promise of successful general application.

Admittedly, generation of electricity at the colliery on a relatively small scale cannot achieve the thermal efficiency of giant power stations, but the fuel will cost nothing and its negative nuisance value will be eliminated.

Further, the utilization of the discard will justify the removal of more of the higher-ash portions in the washing process, thus permitting the improvement of the quality of coal for sale, saving the consumer transport and handling of ash, whilst raising the

Apart from smoke and fumes, nuisance can also be caused by wind-blown dust, from a spoilbank. A recent photograph.

calorific value of the refuse burned at the colliery.

The combustion gases from refuse will have a sulphur dioxide content higher than that from burning coal and lower than that from burning pyrites. The SO_2 concentration, whilst much lower than that from a conventional pyrites plant, should still justify conversion into sulphuric acid, considering that the raw material is provided free of cost.

In cases where the total amount of sulphur available would be too small for installing an acid plant, the gases would have to be discharged through a chimney of adequate height. They would then cause less nuisance than the uncontrolled emission of a mixture of noxious gases and tar vapours from a burning or smouldering spoilbank.

3. *Underground stowage*

Mining subsidence, after being considered by a Royal Commission and various Government committees, still presents an unsolved problem to the experts. The damage calling for compensation as estimated by the National Coal Board is £3 million a year. It can be prevented or minimized by either leaving pillars of coal unworked or by stowage underground of solid material. Stowage is practised in Britain only to a limited extent, by returning to the pit unburned colliery refuse or quarried material.

The burnt-out residue obtained from refuse under controlled combustion conditions would be the ideal material for this purpose. It is safe from spontaneous " gob-fires " to which raw refuse is liable. It is non-plastic and hence does not cause stickiness in either pneumatic, hydraulic or mechanical stowing as do clayey or other colloidal materials. By its use the cost of 1s. 6d. to 2s. a ton of quarried material is saved.

4. *Land use value*

As an important corollary of replacing spoil—made safe by combustion—in the cavities left after mining operations, the encroachment of land by ever growing refuse heaps will be arrested. There are about 100,000 acres of derelict land up and down the country. Mr. Harold Macmillan, when Minister of Housing and Local Government, stated in June, 1954 that in the preceding 10 years 3,500 acres had been cleared in the Black Country, many of them at a cost of less than £200 an acre.

It seems illogical that 1,000 acres a year, worth not less than £50,000–£100,000 in their present state, should be sterilized by covering them with colliery refuse, with the prospect of needing re-instatement in the future at a cost several times its present value.

Economic considerations

There can be no doubt that the present method of disposal of colliery refuse means waste, nuisance and damage from every point of view. Whilst rough estimates of the loss to the nation in terms of money value can be made, the multiplicity of units involved and the variety of their local conditions do not in the light of present knowledge permit of an assessment on an accountancy basis. This is a task for the Government Departments concerned and the National Coal Board.

SMOKE PREVENTION ABSTRACTS

259. The Formation of Sulphur Trioxide in Flue Gases. Crumley, P. H. and Fletcher, A. W. (J. Inst. Fuel, August, 1956, **29,** 322). The factors controlling the oxidation of sulphur dioxide (SO_2) to sulphur trioxide (SO_3) in the combustion of fuels containing sulphur have been investigated in a small kerosine-fired furnace. The SO_3 contents of the flue gases from the furnace were determined chemically, and were shown to depend on the sulphur content of the kerosine, the flame temperature, the amount of excess air and the type of flame. The SO_3 content of the flue gases from a large oil-fired boiler has also been determined and compared with the results obtained in the small furnace.

260. The Domestic Use of Coke. Coley, E. H. (J. Inst. Fuel. August, 1956, **29,** 333). The efforts made since the 1920's to extend the domestic use of coke have recently been given official support in the form of the Simon and Beaver Reports, both of which stress the importance of coke in any programme of coal replacement. Figures are presented which show that there is no evidence of an upward trend in the application of coke, and possible reasons are advanced for its failure to effect any appreciable displacement of bituminous coal. The second part of the paper deals briefly with appliance design and describes—with particular reference to living-room heating—the principal appliance categories in which coke-burning models are available. Performance data given show that the more advanced design of open-fire appliance has a much higher thermal efficiency than that usually associated with the open-fire category.

261. Corrosion Aspects of Air Pollution. Greenburg, L. and Jacobs, M. B. (Amer. Paint J., 11 July 1955, **39,** 64). Corrosion is considered to consist of slow chemical and electrochemical reactions between a metal and its environment, in a restricted sense, and the slow destruction of materials in general by such reactions, in a wider sense. The character of the atmospheres to which materials are exposed may be classified as follows: Rural, Urban, Industrial, Urban-Marine, Industrial-Marine, Marine, Tropical, and Tropical-Marine. Corrosive agents are placed in four major categories. (1) Oxygen and Oxidants; (2) Acidic Materials; (3) Salts; (4) Alkalies. Corrosion attributable to oxygen is deemed to result from the solution of oxygen by a thin film of liquid adjacent to the metallic surface, the transportation of the oxygen through the film, and the subsequent reaction at the surface of the metal. The acid material of greatest importance is sulphur dioxide. The total acidity of the atmosphere is closely related to the sulphur dioxide content. Carbon dioxide and carbonic acid also play a significant role in acid decomposition. Stress is laid on the sticky aspect of tar and tar acids, which means that they cling to surfaces with which they come in contact, thus enabling the acids they contain to have a prolonged corrosive action. It is not considered that salts have a very corrosive action: corrosion inc onnection with them is attributed to the hydrolysis of certain salts to acids. Alkalies are seldom

met with as air pollutants except under certain industrial conditions.

The effects of corrosion on various materials such as metal, building materials materials such as metal, building materials, textiles, leather, rubber, and protective coatings, are discussed. Special mention is made of the way in which particles of charcoal, ammonium sulphate, and silica cause a marked increase in corrosion and that this is accentuated in atmospheres containing sulphur dioxide. The factors determining the effectiveness of protective coatings are considered, as are the effects of weather and the supplementary effects of bacterial action.

262. The Ventilation of Oxford Circus. Whiten, A. J. (Weather, July, 1956, **11,** 227). The author of this note discusses the possibility of the circulation of polluted air from motor vehicles in central London, brought about by the heat of their own exhausts. Flat calm conditions are postulated. It is suggested that the parks and smaller squares form " reservoirs " of clean air, from which the said clean air can flow to replace the polluted air rising in the streets and intersections. This is considered to be a strong argument for insisting on open spaces in built-up areas.

263. Smog. The Rate of Influx of Surrounding Cleaner Air. Gold, E. (Weather, July, 1956, **11,** 230). The implications of the note abstracted above (No. 262), are considered. It is thought that such an effect is possible, but that a non-polluting open space or park would soon lose its original " clean " air and get in its place the inflowing polluted air from the surrounding regions. It is also thought that on occasions when fog in central London is less than in the northern suburbs, the pollution in the centre may be much greater than would be expected from the visibility. Although the visible fog may be lifted over the central area on such occasions (by the greater warmth), it seems possible that the pollution by noxious gases and dust and soot particles, may remain as great as ever in the surface air.

Standard for Smoke Alarms

The British Standards Institution has published a standard specification on " Simple Smoke Alarms and Alarm Metering Devices " (B.S.2740: 1956; price 3s.) The devices described in this standard are intended to satisfy the recommendations of paragraph 35 of the Beaver Report. They apply to black or grey smoke caused by the incomplete combustion of carbonaceous matter. For control of smoke it is preferable to use an instrument, such as one in which a beam of light projected across a chimney is partially obscured by the smoke-laden gases. Simple smoke alarms based on this principle are specified in this standard, whilst instruments capable of indicating and recording the percentage obscuration caused by the smoke will be specified in a later B.S. on " Smoke Indicators and Recorders," now in the course of preparation.

The simple instruments specified in the present standard consist of three main parts (*i*) a light source, such as a lamp and projection system producing the beam of light, (*ii*) a receiving unit, which will usually consist of a photocell and amplifier, and (*iii*) an alarm, preferably both visual and aural.

Some Recent Papers

Among recent papers that deserve fuller mention are three read to recent sectional meetings of the Royal Society of Health. In London, on 13th June, the subject of pollution from road vehicles was discussed, with contributions by Dr. A. Fitton and Dr. E. T. Wilkins, both of the Fuel Research Station, while at Middlesbrough on 29th June Mr. A. H. Basford, Chief Sanitary Inspector for West Hartlepool, presented a most informative analysis and survey of " Atmospheric Pollution on Teesside." This is a model of the kind of review that could well be produced at intervals for all the main industrial areas.

A few reprints are available of a lecture given by Mr. Arnold Marsh, Director of the Society, earlier this year to the Royal Institute of Public Health and Hygiene on " Progress towards Clean Air."

Report from Pittsburgh

Continuing Improvement

THE number of reports, papers, newssheets and other publications coming to us from the United States becomes embarrassing to a journal that is restricted both in size and editorial assistance. So much would be of interest and practical value to our readers if it could be creamed and condensed. There are, for instance, the news bulletins and technical journal of our sister organization, the Air Pollution Control Association; *Smog News* from the American Society of Mechanical Engineers; reports and *Smog Brief* from the vast (to us) Air Pollution Control District of Los Angeles County; reports and digests from the Air Pollution Foundation of Southern California; technical reports on the extensive research that is in progress; and finally the annual reports of the cities that are most actively engaged in air pollution work.

A spotlight may be beamed particularly on Pittsburgh, which (judging from a distance) appears to have achieved the most spectacular results so far in progress to clean air. Whether this is because the city started with more scope for improvement, or because its successful efforts to clean the air have tied in so well with other great schemes to attain a "new look," or because conditions do excel those elsewhere, we are not sure. The fact remains, however, that it is not only Americans who praise Pittsburgh, but British visitors too.

The Report of the Bureau of Smoke Prevention for 1955, compiled by its Superintendent, Sumner B. Ely, gives credit to public opinion:

> "Whatever the explanation, today the citizens of Pittsburgh are solidly behind smoke prevention. If smoke appears in Pittsburgh, the Smoke Bureau immediately gets complaints. Everyone has become a smoke inspector."
>
> "A great factor in bringing about the 'smoke consciousness' has been the work of the United Smoke Council, a strong civic body that

Pittsburgh in 1918. Opposite is an impression of the city in 1955

for many years gave talks to various gatherings in all parts of the city, made radio addresses, wrote newspaper articles, produced public posters, etc. When the citizens reacted to this it produced pressure on everyone, including the few that were against smoke elimination, as well as industry of all kinds."

The Pittsburgh ordinance, like our own new Act, prohibits Ringelmann No. 2 and darker smoke, except when a firebox is being cleaned or a new fire is being built, when No. 2 is allowed for nine minutes per hour, or darker than No. 2 for up to six minutes per hour. In hand-fired furnaces solid fuel containing more than 20 per cent. volatile matter is not allowed. New installations must be approved and except for domestic residences an annual inspection of all heating equipment is made.

The report shows that there has been practically no heavy smoke during the past two years—compared with 1946 a reduction of 96·6 per cent. The reduction of total (i.e., moderate and heavy) smoke over 1946 is 88·8 per cent.

That minority group of critics who maintain that smoke prevention is of no value because sulphur is the real villain of the piece, especially during smog, may do well to consider one short statement from Pittsburgh's report:

> "Smog is a mixture of smoke and fog. However, the fog will evaporate as the sun appears, but if any smoke is present, it will remain. There have been no smogs in Pittsburgh now for several years."

They may also like to consider the implications of the following:

> "Now that Pittsburgh's smoke is greatly cleared, people are becoming more conscious of odours, noxious gases and fumes. The amount of work by inspectors on such complaints has greatly increased in the past year."

On the railway problem, which formerly was so serious a matter to Pittsburgh as it was to other American cities, the report continues:

> "All Pittsburgh railroads are 100 per cent. dieselized except the Baltimore and Ohio, and it will be as soon as it receives the sixty additional diesels promised for delivery in September, 1956. Com-

Before Smoke Control in Pittsburgh—

—and after Smoke Control

plaints of diesels smoking are occasionally made by other cities. As far as Pittsburgh is concerned, there has been no smoke from diesels. The oil burning diesels have solved the railroad smoke problem for Pittsburgh. Any diesel with a smoking exhaust is merely a matter of maintenance. Drivers should not be allowed to tamper with governors and fuel injection equipment. The remedy is stricter supervision of drivers and general maintenance."

Deposit Records

We understand that something is being done to correlate the figures obtained in this country from the standard deposit gauge with the results given by the American dust-can method. This is urgently needed, for without it it is impossible to compare the condition of the atmosphere in Pittsburgh—for example—with our own conditions. The new report gives dustfall figures as shown by the can collector, which range from a minimum in one district of 283 tons per square mile per year, to a maximum of 1,599 tons, the average for twelve stations being 587 tons. Either Pittsburgh has a long way to go before it is truly a smokeless city, or the dust can collects much more material than does our own deposit gauge.

RAILWAY SMOKE CASE

For using a steam engine which did not consume its smoke the British Transport Commission were fined £5, with £15 15s. costs, at Clerkenwell, London, on 10th August. Another case was adjourned until September 18th. Mr. Eric Blain, for St. Pancras Council, said that dense smoke was emitted near a residential street, and it was found that the engine driver was unable to shut the damper because a lever was broken. Mr. Edward Winchester, chief sanitary inspector for St. Pancras Council said, "We realize you cannot have engines without smoke, but this was excessive smoke."

Mr. A. R. A. Beldam, defending, said that the engine was getting up steam. No complaint of a defect was made by the council until after a meeting at the Ministry of Transport. Fireman H. B. Denney said he noticed that the engine was emitting black smoke. This usually happened at first in firing up, and he took what steps he could to reduce it.

The magistrate (Mr. T. F. Davis) said that in all his experience at the court this was the first time a summons of this kind had come before him. "It only goes to show that the Borough Council must be extremely discriminating or forbearing before they come into court on a matter of this kind," he commented. "We know there must be a certain amount of discretion before proceedings are taken out but there comes a time when perhaps there is a bit too much."

He found as a fact that on this particular occasion there was undue smoke coming from the locomotive in question. It was coming in large quantities for quite a long time. It could not be a coincidence that on this locomotive the damper was not working. Even the driver had to admit that the smoke went on longer than it would have done if the damper had been working.

It seemed to him to be a hopeless proposition to put forward, that they had this engine working in a defective condition and that they said it consumed its own smoke "as far as practicable." He rejected the proposition, and was surprised it had been put forward. The engine was defective and it should not have been used. Someone had slipped up.

The Sanitary Inspectors and the Press

The Clean Air Act came into being with the most modest amount of publicity, and the Sanitary Inspectors' Association must be thanked for their enterprise in arranging a press conference to mark the occasion. At this a prepared statement was read by Mr. C. A. Stansbury, who is Chairman of the Association's Legal and Parliamentary Committee, after which questions were asked and answered. Mr. George Rowe, Chairman of the General Council, was in the Chair.

Mr. Stansbury, who is a former member of the Society's Executive Council and has recently been elected as Chairman of the Standing Conference of Co-operating Bodies for the Investigation of Atmospheric Pollution, welcomed the Act, which, he said, was with only a few reservations a sound and realistic piece of legislation. Perhaps the key-note of his address lay in the following passages:

" The success of the Act will largely depend on the energy and enthusiasm which local authorities put into administering it, but they will need the co-operation of owners and occupiers of property. Sanitary inspectors will have the major part of the work to perform and they can be relied upon to play their part to the full in the campaign against air pollution. But, there is a shortage of inspectors and this will make the task more difficult, particularly in the industrial areas where the staffing situation is most acute. There are signs of a slight improvement in recruiting, but it will take several years to make up the accumulated shortage. In the meantime, some local authorities, especially in industrial areas, may have to redeploy their staffs of sanitary inspectors so that the maximum possible attention can be devoted to this important work, which is, after all, only a part of what they have to do."

" The Act is a challenge to local authorities throughout the country and to their officers. They have long complained that they have not had the means to tackle effectively this evil of air pollution. Parliament has now placed the means in their hands. It is up to them to show the public they really mean business."

Chalk Farm Anti-Smog Week

Chalk Farm Tenants' and Residents' Association held a successful " Anti-Smog Week " from 22nd to 28th July. Two of the main events of the week, in addition to the use of publicity material such as posters and leaflets, were a public meeting on Tuesday, 24th July, and a deputation on Wednesday, 25th July to the St. Pancras Borough Council. The meeting passed unanimously a resolution stating that: " This public meeting of Chalk Farm residents demands that the Government authorize the British Transport Commission to take immediate steps, pending electrification, to reduce substantially the smoke and grit nuisance caused by the firing of locomotives at Camden motive power depot by roofing in the shed and erecting a high chimney, with smoke washing plant, etc., or by removal of the depot to a non-residential area." Copies of the resolution have been sent to the Prime Minister, the Minister of Transport, the Chairman of the British Transport Commission, and Mr. K. Robinson, M.P., St. Pancras North.

MORE CANCER IN TOWNS

Mr. R. S. Russell, M.P. for Wembley S., asked the Minister of Health (18th July, 1956) what progress had been made with research into the possible connection between lung cancer and atmospheric pollution.

Mr. R. H. Turton, in a written reply, stated that studies over the last three years had established that the incidence of cancer of the lung was higher among those who live in towns than among those who live in the country. Although the reasons for this had not been specifically established, atmospheric pollution and cigarette smoking were thought to be two possible contributory factors.

" The rate of cigarette smoking is generally greater in urban than in rural areas. The incidence of lung cancer in men who are heavy smokers does not differ greatly in the two types of area, but among men who smoke few or no cigarettes a greater incidence has been found in those who live in towns. It is therefore thought that some other factor must be present, and 3:4 benzpyrene, which is known to be carcinogenic for animals, has been demonstrated in samples of atmospheric pollution in a number of British cities."

Popular Errors Hinder Clean Air

Professor A. B. Semple, speaking at the Liverpool Conference of Heating Engineers earlier this year, said that there were three popular misconceptions which hindered a correct approach to the problem of air pollution.

First—" Where there's muck there's money." Professor Semple said that of course this was a complete fallacy and, in fact, it was well known that where there was muck there was considerable extra expense. He instanced the extra work caused to housewives by the dirt deposits in cities, the extra cost to the household budget, and the destruction of Liverpool's buildings. But, he said, this did not really tell half the story: the great cost came from the effect on human life. There was no doubt that bronchitis in infancy was fostered in a polluted atmosphere, and that ever-increasing disease—chronic bronchitis of middle life—which today was the most incapacitating disease among men in industry after the age of 45 and which was so often the beginning of the cardio-vascular diseases which constituted the highest cause of mortality in this country today, was almost certainly made worse each winter by our polluted atmosphere. He added that air pollution appeared to be a very important factor in the cause of the increasing mortality from lung cancer, and they were conducting considerable investigations in Liverpool into the extent to which atmospheric pollution is a factor.

The second misconception was that the Englishman was completely addicted to a coal fire. This was certainly not true today, and the Englishwoman not only expected a clean and easy method of house warming, but a system of whole house warming. The great drawback to the old fashioned open coal fire was that it limited family activity in winter weather to within a few feet of the fireplace.

The third misconception was a somewhat medical one, in that we had paid far too little attention in the past to cough as a symptom of disease. Cough and catarrh were symptoms of inflammation of the respiratory passages and were very largely due to infection and irritation of these passages. If untreated it was almost certainly bound to be progressive, and sooner or later would lead to severe incapacitating conditions such as chronic bronchitis and, eventually, cardiac failure. Professor Semple closed his address by saying that atmospheric pollution, smoke and fog, was a killer and a cruel killer. It did not cause death quickly but slowly.

A Conference on Oil Firing

THE papers read at the Conference on oil firing, held by the Combustion Engineering Association on 12th April last, contain some interesting points for those concerned with smoke abatement. Of course, as the speakers made clear, all oil firing is a means to smoke abatement, provided that the oil is burned correctly. This proviso cannot be too strongly emphasized, as was shown by the more direct references made to operating rules which must be observed if heavy smoke emission is to be avoided.

The Conference was opened by Sir Graham Hayman, the President of the Federation of British Industries. Speaking of the increased part to be played by oil in our economy, Sir Graham said that coal production was no longer capable of expanding at the rate that the growth of the economy requires. The development of atomic power had made remarkable progress but this source of energy was not expected to make any really large contribution for many years ahead and the gap between energy production and requirements could only be made good by a much greater use of petroleum fuels.

A measure of the change required in our traditional dependence on coal was graphically illustrated in the calculation that our annual consumption of gas, diesel and fuel oils was likely to rise from just under 8 million tons last year to nearly 22 million tons in five years' time.

Mr. R. J. Bressey then spoke on "Oil—The Advantages to be Gained from its Use." After touching briefly on equipment, he listed the four main types of oil available for boiler firing, namely gas oil, light fuel oil, and two grades of heavy fuel oil. These, he said, were available pretty well throughout the country.

Mr. Bressey then went on to quality considerations: (*a*) Calorific value; oil was a very concentrated fuel, occupying 0·9 cu. ft. per million B.Th.U. as against about 1·5 for coal and 3·0 for coke. (*b*) Ash; This was virtually nil for the gas oil grade and would rarely go as high as 0·2 per cent. even for the heaviest fuel oils. There is, therefore, no cleaning of fires, no ash or clinker to be handled and disposed of and no fly ash problem. (*c*) Water. Rarely exceeded a few tenths of one per cent. and easily disposed of. (*d*) Flash Point. Could be regarded as a rough measure of the fire risk of an oil in bulk. Fuel oils did not come within the scope of the Petroleum Acts and when properly stored, fire hazards were no greater than with other fuels. Oil was therefore a high grade fuel, both clean and safe, but its most striking virtue was consistency of quality.

Of the advantages of oil as a fluid fuel, Mr. Bressey enumerated the following: (*a*) Cleanliness. (*b*) Ease of Delivery. (*c*) Ease of Storage. (*d*) Facility of Handling. (*e*) Ease of Measurement. (*f*) Ease of Combustion. (*g*) Ease of Ignition. (*h*) Controllability and Flexibility. (*i*) Smoke Abatement. On the last, he said that with the Clean Air Bill before Parliament, he must not omit to mention the advantages of oil as an aid to smoke abatement—which it certainly was. He would assert categorically that oil could be, and should be, a smokeless fuel—but this did not happen spontaneously. Everyone knew that, if one wanted to, one could so debase combustion conditions as to produce a very effective smoke screen with oil fuel—but, equally, with proper attention to the various factors he had mentioned in connection with combustion, it was easy to burn oil smokelessly, and a smoking chimney was neither necessary nor excusable.

(*j*) Saving of Labour; Oil not only

gave a very considerable saving in direct labour costs but cut down mistakes due to human aberration.

Finally, on the economics of oil firing, the speaker said that oil had never been as cheap as the ordinary run of solid fuels on a crude pence per therm basis, but in some localities and in relation to the more expensive types of solid fuel, oil was competitive even on this basis. In any case oil was still the cheapest form of easily controllable heat which could be obtained.

Conversion to Oil

Following Mr. Bressey, Mr. C. A. Roast spoke on " Oil—Conversion and What it Involves." Mr. Roast referred to the main types of fuel oil for steam raising, the various methods of delivery and storage, and handling equipment and distribution. He then described at some length the techniques which must be adopted for the successful conversion of boilers. In particular, he emphasized that the conversion of Cornish, Lancashire and Economic boilers should follow a definite pattern. After removal of the solid fuel firing equipment and arches, the burner front plate and air director assembly could usually be installed in less than 24 hours of boiler " outage." As the rate of heat transfer at the front end of the flue was not very high there appears to be justification for inserting a ring of refractory brickwork to a length of about 2 or 3 feet from the burner plate. This might assist in stabilising flame shape and contribute towards complete combustion of the fuel.

Combustion should be completed in about two-thirds of the furnace tube length. Burning equipment providing too long a flame should be avoided for shell type boilers. When a long flame passed around the uptake or downtake, the partially burnt particles of carbon in the fuel were chilled and deposits were quickly built up in the smoke tubes or flues. These deposits not only reduced the boiler efficiency but could help to create a public nuisance in the form of stack solids emission.

Mr. Roast went on to say that far too many Cornish or Lancashire boilers depended upon a high chimney and natural draught for coal and oil firing. Even where an induced draught fan was installed the furnace was often starved of sufficient air for the combustion of the solid or liquid fuel. If the designed boiler rating was to be obtained without heavy smoke emission, it was essential that an ample supply of combustion air was provided. As the majority of installations probably had leakages in the brick settings, the speaker submitted that the most reliable method of ensuring the provision of sufficient air for combustion was to install forced draught fans.

Mr. Roast concluded by saying that the oil firing of industrial boilers presented no difficulties provided that the equipment was installed in a competent manner and operated accordingly. To obtain trouble free operation and a high overall efficiency the correct type of burning equipment must be installed and should be well maintained. The efficient burning of residual fuels was a relatively simple process and higher oil atomising temperatures than hitherto would accelerate combustion of the oil droplets and thereby further reduce the relatively small quantity of flue deposits and stack solid emission. The morning session of the Conference closed after questions on Mr. Roast's paper.

Modern Equipment

The afternoon session opened with a paper by Mr. D. J. Heslop on " Oil—Modern Burning Equipment for New and Existing Boiler Plant," which was followed by a Brains Trust consisting of Mr. J. T. Bookey, Mr. J. R. Boyce, Mr. R. J. Bressey, Mr. H. C. Hawkins, Mr. Heslop, and Mr. C. A. Roast. The chair was taken by Mr. G. H. Buckle.

In the course of his talk Mr. Heslop said that atomization could be pro-

duced by several methods. The pressure jet or whirl spray was showing a tendency on big industrial work to use higher pressures. These were increasing from 150 to 500 and more lbs. per square inch. Finer sprays and smaller droplets were obtained at these higher pressures. Such small droplets assisted in the burning of heavy fuels with the minimum of smoke when excess air conditions were closely controlled. The increase in the temperature of these small droplets and thus their readiness to ignite was ensured early in the flame travel without errant sprayed drops, which produced smoke and carbon.

Mr. Heslop further pointed out that according to one well-known authority on oil burning (Sambrook), for combustion conditions of 11 per cent. CO_2 and Shell smoke number 5 a distillate (gas) oil would produce 0·06 per cent. by weight of the fuel burnt in the form of stack solids. But if the same combustion and smoke conditions were obtained with a heavy (950 seconds) oil, the stack solids would have increased to 0·4 per cent. of the fuel burnt. For this reason it was necessary that atomization, air mixing and air to fuel ratio were maintained at the optimum conditions. The production of smoke through unburnt fuel prevented the use of ratios less than 15/1, but there was no chemical or physical limits for fuel oil burning similar to the 19/1 figure for the petrol engine. Excess air conditions in fuel oil burning in which the percentage of excess air beyond theoretical requirements was as high as 400 per cent. did exist.

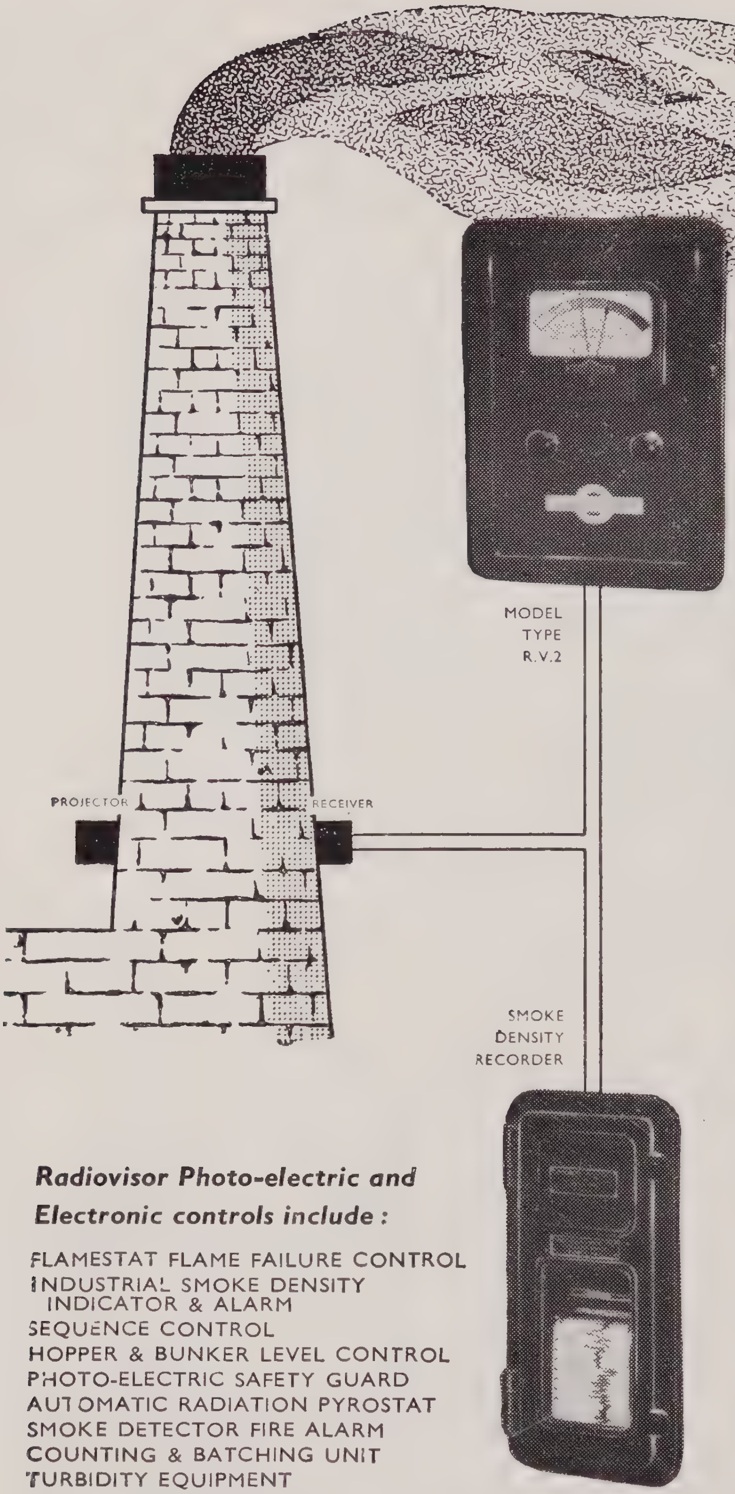
During the discussion on Mr. Heslop's paper he said, in answer to one questioner, that if atomization was poor or the preheat temperature low, the droplet size would be big. If the atomizing medium of oil pressure, air pressure or spinning cup was deficient, atomization would be poor. Burner damage could also affect atomization. Until the three phases of preparation, atomization and air mixing were correct, good burning could not be attained; if there was a basic trouble in air direction or air supply the attainment of full load on a shell boiler without smoke would be difficult.

Sulphur

During the Brains Trust session which followed one delegate mentioned Mr. Roast's statement that the sulphur content of 3,500 seconds oil was something over 4 per cent. This delegate then asked what was the panel's view concerning the ultimate solution of the sulphur problem, and would the oil companies be able to remove it at source? Mr. Bressey replied that the Middle Eastern fuel oils in the heavier ranges had a sulphur content of up to 4 per cent. and the fact was that at present there was no known way of removing sulphur from these residual oils at a reasonable cost. Such processes as might be applied would probably cost £4 or £5 per ton of oil and he did not think anybody would be prepared to pay this amount more for the privilege of getting a low sulphur oil. After referring to the gas washing processes such as that practised at Bankside, which were also expensive, he said that in his view the right answer was to get the flue gases out at a sufficiently high level so that they were dissipated by ordinary natural forces. It was a question of adequate dissipation by adequate height of stack.

COUNCILLOR OLIVER INMAN

We regret to have to record the death of Councillor Oliver Inman, a member of the Stocksbridge U.D.C. and a director of Samuel Fox and Co. Ltd., of that town. Both his firm and his authority (through the Sheffield and District Joint Committee) are members of the Society, and his interest in smoke abatement and in the Society's progress was therefore two-fold. He attended many of our annual conferences.



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SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL

No. 100 WINTER 1956

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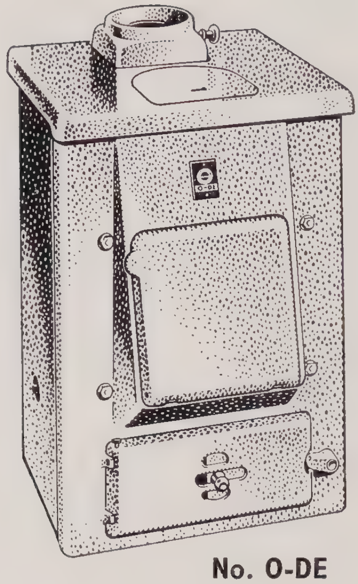

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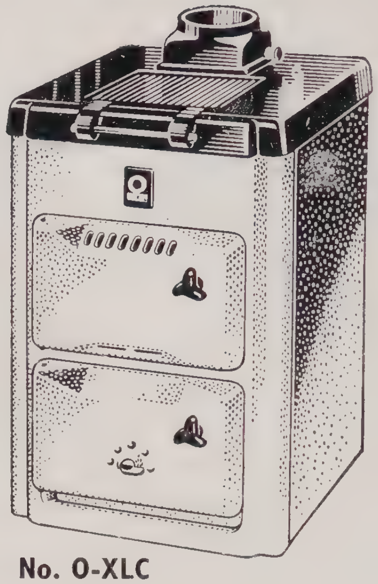

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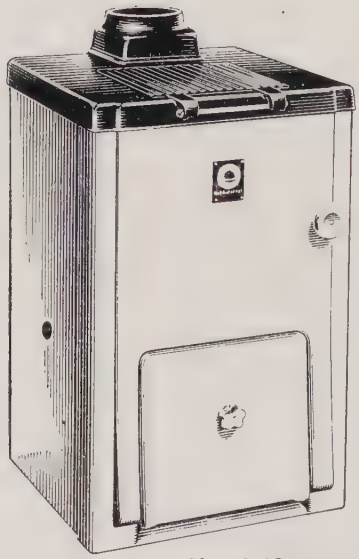

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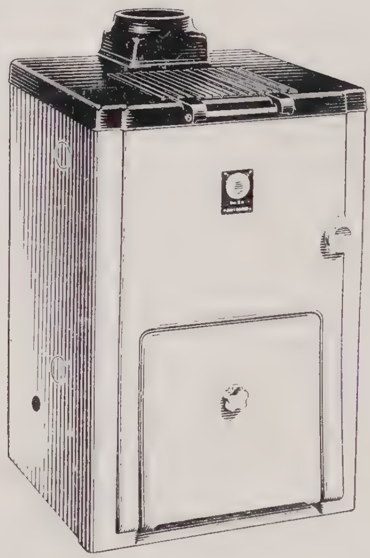

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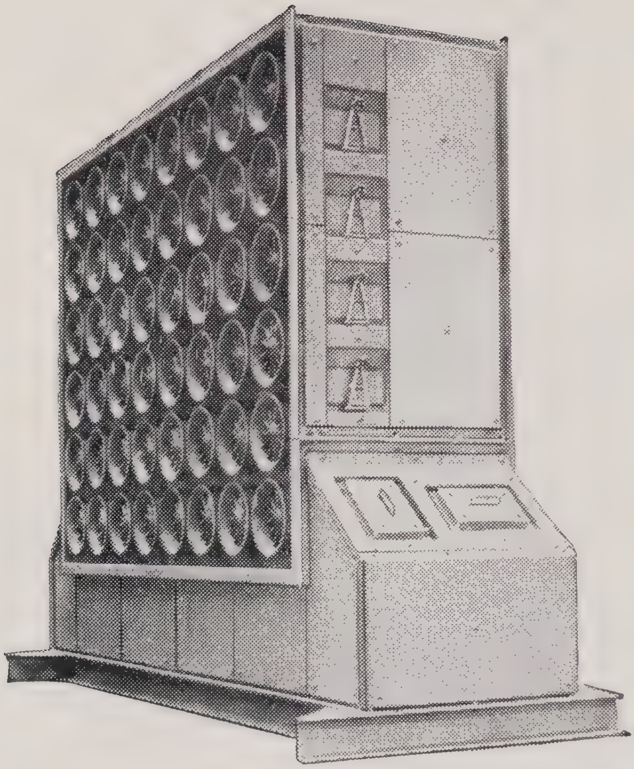

National Smoke Abatement Society

CENTRAL OFFICES: Palace Chambers, Bridge St., London, S.W.1. (TRAfalgar 6838-9)

MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership application form will be sent on request.

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SMOKELESS AIR

Vol XXVII. No. 100 Winter 1956

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SMOKELESS AIR is published quarterly by the National Smoke Abatement Society at Palace Chambers, Bridge St., London, S.W.1. Tel : TRAfalgar 6838-9 (Editorial and Advertising). Issued gratis to Members and Representatives of Members. Subscriptions rate for SMOKELESS AIR only, 4s. per annum, post-free.

Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

Comment

Centenary

ALL that we are publishing in celebration of our hundredth number are the two letters we are grateful to have received from the Ministers concerned with clean air and the means for attaining it; and an article describing the story of the journal. It may of course be said that with the cover we have succeeded in producing " a bright and glittering " *Smokeless Air*. The fact is that there is so much of interest to report that there is no more room for mere birthday business. Our first number contained messages from the then Prime Minister, an Archbishop, several Lord Mayors and Lord Provosts, and other notabilities. It was useful then to seek to show we had such approval: today, *Smokeless Air* can stand on its own feet.

Nevertheless, the 100th number of a quarterly is a landmark and it is fitting that it should occur when the opportunities for this journal are so rapidly growing. It is tempting to reflect on the course that may be taken as we proceed towards the second hundred, and whether indeed we shall ever need to reach it. If the journal remains a quarterly, perhaps not; but it is becoming more and more desirable that, as soon as funds permit, it should become a monthly. In either case there will be plenty for *Smokeless Air*, the intelligence organ of the movement, to report and discuss as activities develop and progress is made under the clean air campaign demanded by the Beaver Committee. If that progress is not made, there will be plenty of scope and need for us to hammer away at the obstacles. Or to nag at the laggards.

Beginning to Move

As was stressed in different ways at the Southport Conference by Mr. Enoch Powell, Sir Hugh Beaver and Sir Ernest Smith, now is the time for the building up of the forces needed for the assault on air pollution that can begin as soon as the Clean Air Act comes into force. There are many signs of active preparation among the local authorities, although it must be confessed that these are not yet as widely apparent as we would have expected. We would also like to have reports on what industry is doing during this period—which was intended to help it to put its house (or rather plant) in order before the appointed day.

On the fuel front there are interesting developments. Elsewhere in this issue we give an account of the new solid fuels " Thermalite," " Thermax," and " Cleanglow," and of the new Avenue carbonization plant of the N.C.B. near Chesterfield. These are all most welcome developments, although the amount of fuel to be produced is, we trust, only a beginning. As Sir Hugh Beaver pointed out in his Des Vœux Lecture at Southport, the creation of smoke control areas, at the rate necessary to meet the 10 to 15 year programme proposed by his Committee, means at least an additional million tons of smokeless fuel *each year*. We still have a long way to go.

Another important and very necessary development is the one announced by the Minister of Fuel and Power, Mr. Aubrey Jones, at the Avenue inauguration. He is setting up machinery to promote co-ordination between producers, distributors and local authorities to ensure that the smokeless fuels produced were available in the right places. This is extremely important if the smoke control area programme is to go forward smoothly and if local authorities are to know how far, and how fast, they can proceed.

Southport

Two contributed accounts, or impressions, of the Southport Conference are given on another page. The difference between the two points of view is interesting, one writer being a local authority representative, and the other a technical man who, we believe, hears the local authority viewpoint only at our conferences. As he points out, it is the getting together of the two arms of the clean air movement that makes the Society's conferences—and the Divisional meetings—so valuable. The Southport Conference was not only the biggest we have had, with an attendance of 679, but has resulted in more expressions of approval and satisfaction than usual. At headquarters we judge a conference not by our own impressions but by what we hear of the impressions of the members of the Conference themselves. Like a public speech, the success of a conference depends very largely on how it begins and how it ends—on this occasion by Mr. Enoch Powell at the beginning and Sir Hugh at the end. Add to this the excellence of the sessions in between, season with a delightful evening reception by the Mayor of Southport—and you have the recipe for a good show.

The 1957 Conference, those interested might like to note, will be held at Hastings on 2nd to 4th October. We hope to outline the programme in the next issue.

Plugging

As has happened before, there were a few mild murmurs at Southport that those concerned with the production of smokeless fuels and appliances were " plugging " their wares in the papers and discussions. Sometimes an over-enthusiastic advocacy of some product does seem to be advertising pure and simple, but generally speaking we think that a sensible restraint is exercised. If it is not it does the plugger more harm than good. The point about this perennial problem is that clean air demands not only administrative action but the practical use and development of commercially marketed goods and services, be they fuels or boiler-house instruments. Information about these things—their availability, efficiency, cost and all the rest—is necessary, and it is one of the functions of the conference to make known and discuss—and where necessary, criticize—this information. It is not quite fair to treat this information as plugging, provided of course that it is presented in a suitable way. It is all a matter of balance and good taste. It was suggested, outside the conference hall and with what we feel was rather heavy irony, that all would be well and there would be no complaints if there was a prohibition on any mention of fuel, appliances, instruments, firms, national boards, Government departments and local authorities!

An N.D.F.E.S.?

A writer in *Coke and Gas* has made the interesting suggestion that there is a need for a fuel efficiency service comparable with N.I.F.E.S., devoted entirely to promoting and advising on the domestic efficiency of fuel. A National Domestic Fuel Efficiency Service. The obvious point is made that the advisory services that are available to the householder are concerned exclusively with one or other of the different fuels—gas, electricity, solid fuel, and to a smaller extent, oil—and that there does not exist an independent body that can give dis-

interested advice over the whole of the domestic heating field. The N.S.A.S. is, in fact, one of the very few bodies that is interested in domestic heating without bias towards any one fuel or system (provided, of course, that it is smokeless. If it is not then the only advice necessary is *don't*). We frequently do make suggestions, or give information about domestic heating matters, but it would be beyond our scope to do this more than incidentally, and in any case it would seem that the matter should be the exclusive purpose of a special organization. How such a body might be formed, how it could be financed, and whether indeed it really is desirable, are matters for discussion. It is at any rate an interesting proposal and one that could help the drive for clean air.

Unsuitable Fuel Again

Presumably to raise a laugh " Peterborough " in the *Daily Telegraph*—copied by several other columnists—quoted the statement in the Society's *Summary of the Clean Air Act* which explains that one of the defences to dark smoke emission is when it can be shown that it was due to " the use of unsuitable fuel, suitable fuel being unobtainable and the fuel that was used being the least unsuitable that was obtainable."

We knew that this was not very elegant and that it had to be read with care, but it was the best we could do with this clause, which we never liked anyhow. And if it comes to poking fun at the darned thing " Peterborough " is behind the times. He presumably didn't read the conversation about it between Alice and the Red King in our summer issue. Still, the publicity he has given to the clause, if not quite suitable, is not exactly unsuitable.

Post Script

Our offices recently received a letter addressed to " The Clean Air Act, Palace Chambers, Bridge Street, S.W.1." We are hoping that our correspondent was not using "Act " in its stage sense!

Conference Resolution

The following resolution was adopted, *nem con.*, at the annual conference of the Society at Southport in October:

" THAT this Conference of the National Smoke Abatement Society welcomes the Clean Air Act and reaffirms its determination vigorously to pursue its policy of securing clean air. It urges:

(1) That since the effective implementation of the provisions of the Act largely depends on an informed public opinion, all local authorities should, without delay, initiate a well-directed plan of publicity and education.

(2) That local authorities should now take immediate action in order to be prepared to administer and implement the Clean Air Act.

(3) That the Minister of Health and the local authorities should take all necessary steps to augment the Public Health Inspectorate so that the provisions of the Act may be effectively implemented.

(4) That H.M. Government should take all necessary steps to make generally available supplies of smokeless fuels at prices which will favour their use."

The resolution has been submitted to the Ministers of Housing and Local Government, Health, and Fuel and Power. It has also been forwarded to every local authority. The communication to the local authorities asks for the resolution to be brought to the notice of the appropriate Committee, and states that " we would find it most helpful if, in due course, we could be informed of your Council's views or action."

We would like to take this opportunity of asking local authority readers to assist us in obtaining reports of this kind. These are required to help the Society to give publicity, either in *Smokeless Air* or elsewhere, on the progress being made generally—or where it is particularly interesting, in specific instances.

Our Hundredth Issue

Congratulations from Ministers

From the Rt. Hon. Duncan Sandys, M.P.
Minister of Housing and Local Government

I warmly congratulate the National Smoke Abatement Society on the publication of the one-hundredth number of *Smokeless Air*.

For many years this quarterly paper has given persuasive expression to the Society's aims, and it has, I am sure, played a most valuable part in stimulating public interest in the problem of air pollution.

It is appropriate that the one-hundredth number of *Smokeless Air* should follow so closely the passing of this year's Clean Air Act. The fact that the cause it advocates has now been so widely adopted does not, however, diminish in any way the importance of the Society's work. On the contrary, the practical task of implementing the new Act is now about to begin, and an active and informed public opinion will be more than ever essential to success.

I hope that *Smokeless Air* will continue to be a source of strength and encouragement to its many readers, until its mission is finally accomplished.

From the Rt. Hon. Aubrey Jones, M.P.
Minister of Fuel and Power

I offer my congratulations and good wishes to *Smokeless Air* on its hundredth issue, personally as a sufferer from London's polluted atmosphere and officially as Minister of Fuel and Power. Part of my duty is to promote economy and efficiency in the use of fuel, and in practice this is the only way to achieve smokeless air. A dirty smoky atmosphere means that a large proportion of the valuable heat in coal is being squandered; smokeless air shows that it is being used to the best advantage. The objective and the means are the same. The Society has worked for cleaner air primarily for health reasons, while I look to it as the outward sign of efficiency in boiler houses, furnaces and, above all, in the domestic grate which is blamed for half the dirt in the air of our cities.

We need every ounce of fuel we can produce to maintain our present level of industrial activity. We shall need more if we are to expand it. The fuel industries are doing all they can to provide the fuel the nation requires in the form in which it is wanted. But efficiency in the use of fuel is equally important for closing the gap between our supplies and the demands we have to meet.

Neither the general fuel problems of this country nor the special problems associated with the drive for cleaner air will be solved overnight. There is still much to be done, particularly in educating public opinion in the means to achieve fuel efficiency. I hope, therefore, that *Smokeless Air* will continue to play its part in this important task and that each succeeding issue will be able to report further progress towards our common objective.

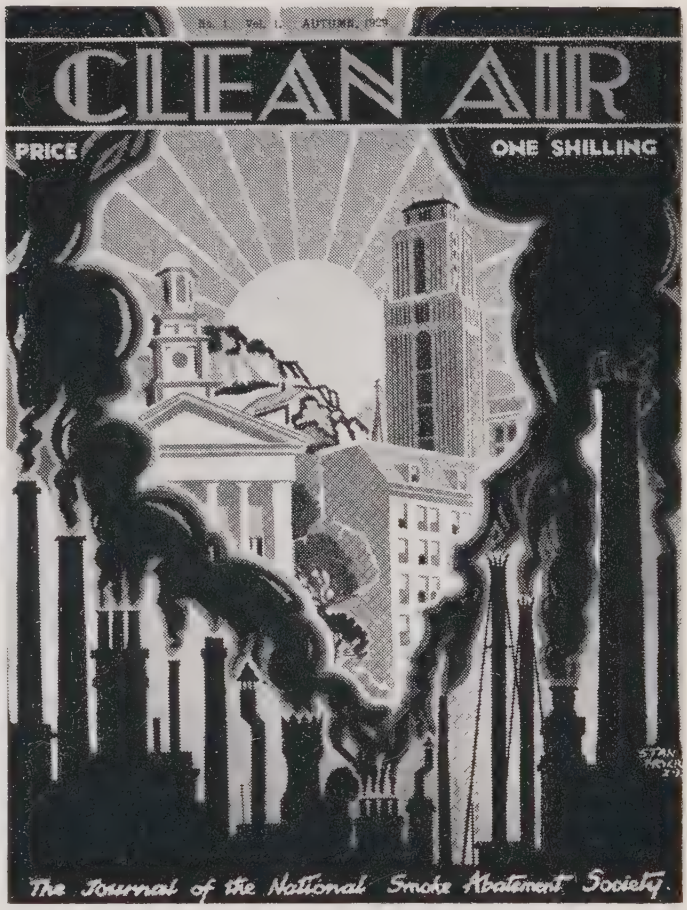
The Story of "Smokeless Air"

By the Editor

To our newer readers, the 100th issue of *Smokeless Air* may not seem to be an event of any great significance, even for a quarterly, but to those who have watched and encouraged its efforts over the years it is perhaps an occasion for a celebration.

One confusing point should be cleared up first of all. The first issue appeared in the autumn of 1929, but it has taken 27 years, instead of the 25 that simple arithmetic would suggest, to attain the centenary. This is because for a period during and after the second world war, because of paper shortage and lack of staff, there was an enforced publication of only three numbers a year.

As the illustration of our first issue shows, the journal was originally called *Clean Air*; thus anticipating by over a quarter of a century the term that is now rapidly replacing " smoke abatement." That the title was not retained was due to the fact that our attention was drawn to the existence of a bulletin of that name published by an anti-tobacco society. We received an offer to amalgamate both publications and societies, but it was quickly decided to reject this proposal and to change the name of our own journal. For some years it was called simply " The Journal of the National Smoke Abatement Society."



The startling cover of No. 1, Vol. 1

From the start the journal was an adequately printed and illustrated publication, and its production was made possible only by reason of an arrangement made with a firm in Manchester (where our headquarters then were). We provided the editorial matter; they secured the advertisements and with the revenue printed the journal without charge to the Society. The Society was at that time so small and penurious that only through such a scheme could the publication of a regular quarterly magazine be undertaken.

There were, however, disadvantages to this procedure, including lack of control over layout and presentation generally. The publishers, for instance, would promise " facing editorial " space to virtually every advertiser! So, as the signs grew that the journal was being appreciated and was exercising a useful influence, and ought to be made more attractive, it was decided, early in 1939, that the Society would take over the whole job: editorial, advertisements, printing

arrangements and distribution. A large quarto page and an attractive, open format were decided upon, and —supported by a poll of readers—a new title was adopted: *Smokeless Air*.

The first of the new-look journals appeared in the spring, and the second in the summer, of 1939. The latter records a pleasing tribute from the then Minister of Housing, the Rt. Hon. Walter Elliot, M.P., who congratulated the Society on "the elegance and attractiveness of the new decor and production in which *Smokeless Air* has appeared this month."

The third issue was in course of preparation in September, 1939. The war broke out, advertisements were cancelled, and as the Society's own position was extremely uncertain, that number was never completed. Smoke abatement seemed to have no place in a country engaged in total war, and for a time it was feared that the Society would become moribund and that the *Smokeless Air* venture had ended.

Nevertheless an Autumn number *did* appear—a thin, "special issue" of eight small pages. Thereafter it continued to appear regularly throughout the war, becoming more and more compressed and then appearing only three times in the year. The small page has been retained since then simply because —as far as we can judge—our readers prefer it this way. (or are we wrong?—we would like to know). Quarterly publication was resumed in 1949, and from then on the journal has grown in size, in the number of advertisements it carries, in circulation, and, we trust, in interest.

Until recently, when clean air came to the fore in the U.S.A., *Smokeless Air* had the distinction of being the only periodical in the world devoted to air pollution and its problems. It was started by a small and struggling Society to maintain the interest of its members, to help to get new members, and to spread information and secure publicity for its cause. It was quickly found that it had indeed a useful part to play, and that it was exercising an unexpected amount of influence. It is frequently quoted in the press and from time to time has had encouraging words of commendation about its contents or its good looks. Going as it does to every member of the Society and to many libraries and desks, it is read (or at least perused) by 10 times as many persons as attend even the biggest clean air conference.

A word of thanks should be expressed to our advertisers, without whose announcements the journal could not be produced in anything like its present form. Some of them have supported us for many years, or even from the beginning,* and it is gratifying to find that once they have been persuaded to come in they stick quite nicely!

As a means for keeping in touch with all members of the Society and of giving a sense of joint purpose to the membership, the journal has at all times been useful, but during the war years, when no meetings could be held, it was indispensable. Step by step in its attenuated pages it discussed and developed the ideas that put smoke prevention well on the map of post-war reconstruction reports on fuel policy and housing. A great deal of what is now accepted policy can be found, even if only in embryo form, in the back numbers of *Smokeless Air*.

In 1942, of all years, it outlined a "Ten Year Plan" to end the smoke problem. This was a plan for the abolition of smoke in the urban areas by the establishment of smokeless zones, or modified smokeless zones, which by steady extensions could be carried through in 10 years. In more ways than one this article, and the

*The first issue included advertisements from the Electrical Development Association, Coalite, Radiation Ltd., the National Radiator Co. Ltd. (now Ideal Boilers and Radiators Ltd.), the British Commercial Gas Association (now absorbed in the Gas Council), Babcock and Wilcox Ltd. (now represented by Edwin Danks & Co. Ltd.), and South Wales smokeless coals organizations now represented by the Solid Smokeless Fuels Federation.

discussion among readers that followed, foreshadows the more precise proposals, 12 years later, of the Beaver Committee. Also in 1942, to give another instance, there appeared the first analysis of the provision of solid smokeless fuels for a smoke-free Britain, by Dr. G. E. Foxwell—a precursor of the well-known appendix on the same subject by the same author in the Beaver Report.

The Editor's View

As *Smokeless Air* has had the same editor throughout its life, a personal note may not be out of place. Of all the duties for which he has been and is responsible to the Society, the production of this journal is always felt to be one of the most rewarding—even if, more often than not it is also the most exacting. The sense of satisfaction it provides stems from a conviction that the journal has been, and remains, the most important channel open to the Society for communicating its ideas and policies and for giving to our organization a kind of organic unity or coherence that it would not otherwise possess. It has held the Society together through difficult times, and, it is hoped, has played its part in building up the status and prestige the Society now enjoys.

Editors, of course, are noted for their regrets. Our main regret is that it has not yet been possible, for financial and staffing reasons, to turn *Smokeless Air* into a monthly. During the last few years the three months gap between one issue and the next has been most exasperating. More frequent publication would not only mean more up-to-date news and reports but would allow us to publish much more of the material that is available but cannot be used.

One thing an editor must do is to study and cater for his readers. The N.S.A.S. derives its strength and independence from the wide variety of its membership, which ranges from the highly technical to those whose interests are purely altruistic or aesthetic; from those who have been "in" on air pollution for years and know all about it, to those who have just become interested. To include something for every reader is not always easy, but on the whole the mixture as delivered seems to turn out about right. At one time members were asked, in a questionnaire, to give their views on what kind of publication it should be. Roughly one-third wanted it to be more technical, one-third wanted it to be more popular, and one-third preferred it as it was. So we continue to try to keep to the happy mean . . . .

SIR FRANCIS SIMON

We regret to record the death, on 31st October, of one of the Society's most distinguished members, Sir Francis Simon, C.B.E., F.R.S. Sir Francis, who came to Oxford from Breslau in 1933, was a leading authority on low temperature physics, and did much of his work at the Clarendon Laboratory. He had been Professor of Thermodynamics since 1945, and only a month before his death had succeeded Lord Cherwell as Dr. Lee's Professor of Experimental Philosophy. His death, at the age of 63, is a great loss to Oxford and indeed to the country.

Sir Francis's interest in smoke abatement, and his membership of the Society, arose from his considerable interest in fuel efficiency and coal conservation: an interest vigorously expressed in many papers, newspaper articles and books. He was genuinely shocked by the appalling waste of energy that is allowed to continue, to our cost, by our failure to apply our scientific knowledge at all effectively. Only a short time before his death he had suggested that Great Britain ought to have a Minister of Science and Technology in the Cabinet if she were to survive until the coming of the age of plentiful nuclear power.

The New President

Dr. R. Lessing may not be the oldest member of the Society, but he has certainly put in more years of active service for clean air than any other living member. It was in 1908 that he first became associated with the Coal Smoke Abatement Society in London, giving Dr. Des Vœux and his other colleagues the scientific and technical guidance needed for the development of practical policies for the abatement or prevention of air pollution.

He was Hon. Secretary of the Conference Committee for the International Smoke Abatement Exhibition held in 1912 under the auspices of the Society, and was one of the founder members of the committee set up for the investigation of air pollution—a work which, today under the wing of the D.S.I.R., has become so extensive. Ever since these early days Dr. Lessing has maintained a close and active interest in the Society. " Active interest " is perhaps too commonplace a term, for with Dr. Lessing it should signify a notably energetic and thorough kind of interest, with an unfailing grasp of every pertinent detail. Until his election as President he was a Vice-President of the Society and, as a member of its Executive Council, the first chairman of its Technical Committee.

The President graduated in chemistry at Munich, and after studies at Geneva and Berlin he did post-graduate research at Manchester. He studied under such men as Baeyer, Fischer, Willstätter and Röntgen, the discoverer of X-rays, and, when at Manchester with W. H. Perkin, Junr., he did some work for the Professor's father, Sir William Perkin, the discoverer of the first aniline dye.

His concern with coal began with a research post at the Gas Light and Coke Company, but by 1907 he had established himself as a consulting chemist and chemical engineer. Today, untired and unretired, he remains as a leading consultant, particularly in the field of fuel.

R. LESSING
Ph.D., F.R.I.C., F.Inst.F., M.I.Chem.E

Dr. Lessing brings expert professional knowledge to more than one aspect of the problems of air pollution. Pollution arising from the mineral ash and dust in coal is one of the major factors in the problem, and he is a pioneer—or rather, *the* pioneer—in the cleaning of coal. Not only does clean coal mean less ash to get into the atmosphere, but it also means less sulphur to form the destructive sulphur oxides in the flue gases. In the difficult problem of washing the sulphur gases from chimney emissions Dr. Lessing has again been a pioneer, and the process used at the Fulham power station before the war was developed by him from the laboratory stage.

The list of offices that are or have been held by our President, and of the bodies that have honoured him in other ways is too long to record in detail, but his membership of the

Beaver Committee on Air Pollution, for which no one was more fitted, must be mentioned. He has seen many changes in the outlook for clean air since, as a young chemist, he first sat in committee with Des Vœux, Chubb, Napier Shaw and Owens, and we are glad that he has been able to accompany the Society as it moves forward, with growing responsibilities and firmer hopes, from smoke abatement to clean air.

A. P. IN NORTH AMERICA

Among new publications and reports received by the Society is a most informative memorandum of nearly fifty duplicated foolscap pages from the United Kingdom Scientific Mission in North America. It is entitled **Air Pollution in North America,** and is by J. F. Martin. (U.K.S.M. Memo. 21/56, British Commonwealth Scientific Office, 1907 " K " Street, N.W., Washington, D.C.). The memorandum is not published for sale but is marked " Open Distribution."

Among a great many paragraphs we would like to quote the following may be picked out:

" It is said that all but three of the thirty-five cities with populations exceeding 300,000 have reported that the local air is contaminated, and at least seventy bills were before State and local legislatures in 1955. This is in addition to a great volume of earlier measures under which the great majority of American cities have some form of air pollution control. . . . National awareness of the increasing importance of clean air to public well-being is reflected in the passage by Congress in 1955 of Public Law 159, which recommends the expenditure on research on air pollution of some $5,000,000 per year of Federal money for five years."

Warning against the assumption that A.P. in North America is identical with that in Great Britain, the author says:

" Differences in the problem in the two countries are particularly obvious with respect to availability of fuel supplies. The commonly quoted U.S. achievements, viz. the improvements which were effected in the 1940s in Pittsburgh and St. Louis, were brought about by using readily available supplies of oil and natural gas in place of coal. Even when the use of solid fuel had to be continued, supplies of low volatile coal were at hand. There is little doubt that prohibition of the use of high volatile coal improved visibility in these cities, but it is also evident even to the casual observer that air pollution by grit and dust is still prevalent in such cities as Pittsburgh and Chicago."

The memorandum gives information on the principal bodies in the U.S. engaged in research and other A.P. activities and outlines the nature of the control ordinances commonly used. A further chapter gives technical details of recent work on the contribution of petroleum products to pollution and points out that the research effort in the U.S. is mainly concerned with this particular problem. A further chapter gives an account of work proceeding in Canada, and finally the Director of the U.K. Scientific Mission, H. J. Hadow, contributes a postscript indicating some trends for the future. There are also some useful bibliographies.

Mechanical Engineers and Clean Air

A conference on " The Mechanical Engineer's Contribution to Clean Air," sponsored by the Institution of Mechanical Engineers, is to be held in London on 19th to 21st February. An impressive programme of some seventeen papers has been drawn up, covering between them most of the technical aspects of the problem, particularly as they concern the mechanical engineer. The conference is open, on registration, to members of other institutions and societies, and the fee of 25s. includes a set of advance copies of the papers. Details may be obtained from the Institution at 1 Birdcage Walk, London, S.W.1.

Mr. Powell on the Clean Air Act

The address on the Clean Air Act at the Southport Conference by the Parliamentary Secretary to the Minister of Housing and Local Government, Mr. J. Enoch Powell, M.B.E., M.P., will be published in the Conference "Proceedings," but it is reprinted here for the benefit of the many readers who do not see that volume.

Anyone addressing a conference of this Society who is not himself an expert and specialist in any of the subjects which its interests cover is in grave danger of "teaching his grandmother"; and for the mere politician, however close an interest he has taken in clean air, the difficulty of finding something new to say to you is almost insurmountable. I think that I can claim to be no stranger to your purpose. From my first entering Parliament, I took part in, I believe, nearly every debate involving fuel conservation.

My name was one of those on the back of the private Member's Bill tabled by my friend, Gerald Nabarro, at the end of 1954, and in my present Office I took part in every stage (after Second Reading) of the passage of the Clean Air Bill through the House of Commons. I hope, therefore, you will be prepared to regard me at least in the light of an associate.

My presence here today, however, is not in a personal capacity but as evidence of the Government's enduring practical concern in the reduction of air pollution. This concern is not, as sometimes suggested, of recent date; and the provisions of the Clean Air Act are sufficient in themselves to ensure that it will be continuous and protracted.

I could go back to pre-war, even pre-first war public health legislation, but will be content to start by pointing out that the Beaver Committee itself was a Government Committee.

It is sometimes said that committees are appointed as a means of deferring rather than stimulating action, but that was certainly not true in this case. Within two months of the publication of the Committee's report, the Minister announced in the House of Commons that the Government accepted the Committee's recommendations in principle, and a fortnight later, at an opportunity provided by the Second Reading of Mr. Nabarro's Private Member's Bill, the Government undertook to introduce a comprehensive Bill on the lines of the Committee's recommendations.

The report of a Departmental Committee on such an intricate and important problem can seldom have been acted upon so speedily by the Government of the day.

Since the Clean Air Act reached the Statute Book in July, a host of new Government responsibilities have come into existence, the most obvious of which is to bring the Act itself into operation.

I have already announced elsewhere that the Minister intends to fix a day before the end of this year for the commencement of the provisions relating to smoke control areas (Sections 11-15), new furnaces (Section 3), the height of chimneys (Section 10) and various other provisions of the Act which will be required in connection with those Sections.

For the purposes of this stage, certain other machinery is necessary. Regulations are in preparation to prescribe the authorised fuels for use in smoke control areas, and the Minister will be making an Order in due course in regard to the appliances

which are to be exempted from Section 11 of the Act. The latter, it will be remembered, gave rise to a good deal of discussion during the passage of the Bill through Parliament, when fears were expressed in some quarters that these exemptions would tend to defeat the purpose of smoke control areas.

The Minister intends, however, to interpret strictly the words in Section 11(4) " without producing any smoke or a substantial quantity of smoke," and to exempt only those methods of firing which can make a real contribution to the abolition of smoke, without consuming the authorized smokeless fuels.

The Minister will also, in due course, be making regulations under Section 4 regarding the use of smoke density meters, and under Clause 7 in regard to the measurement of grit and dust emissions from furnaces. At his request the British Standards Institution are already at work on the preparation of specifications for both these purposes.

As local authorities avail themselves of the provisions for creating smoke control areas, the Minister's duty of considering and confirming the orders which they make will come into play. This will, in certain cases, involve the holding of local inquiries.

Smoke control areas too involve Government participation of a quite direct and concrete kind—the paying of an automatic contribution towards the expenditure duly incurred by local authorities and private individuals in the necessary conversion or replacement of appliances.

The Main Dish

Though this first administrative mouthful will require some mastication, the main dish of the meal will of course be served when, in the spring of 1958, the remainder of the Act, that is to say, the provisions for the prevention of dark smoke, grit and dust, provisions mainly affecting industry, will be brought into force.

This is in accordance with the Beaver Committee's recommendation that a suitable interval should be allowed to enable industry to carry out any necessary alterations and improvements to plant and equipment in order to comply with the new requirements.

May I take this opportunity once again to stress, and to ask your Society's help in stressing, that although these provisions will not be in effect for eighteen months, it is during just those eighteen months that the bulk of the work which they necessitate ought to be done. People must not suppose that they can wait till 1958. The less use that is to be made of the temporary provisions in Section 2 the better. I may also add the less use that is to be made of prosecutions and penalties the better.

I may take the opportunity at this point of saying a word about Section 2 of the Act, which deals with the 7-year " period of grace " as it has been called. It is not quite that.

It should be clearly understood that the Section does not allow any general exemption from the prohibition of dark smoke in Section 1 of the Act during the 7-year period. It will afford only a limited defence—limited in scope and limited in time. To establish the defence, it will be necessary to prove that the emission of dark smoke was due to the nature of the building or its equipment—and not to lack of maintenance or improper use, and that the necessary alterations or new equipment could not have been completed by the time the contravention occurred. Even by the appointed day for Clause 1, eighteen months or more will have elapsed from the passing of the Act, so that the number of cases in which the defence could be pleaded successfully after that date are likely to be few, and to become progressively fewer as time goes on. It should be noted, and we hope that industry generally will have taken notice of this, that the 7-year period in Clause 2 runs from the passing of the Act, another reminder that if alterations or improvements are needed to comply with Section 1, they should be under-

taken now and not deferred. If they are deferred, when they might have been carried out, the defence in Section 2 will be of no avail.

" Smoke prevention," you may say to me, " begins at home "; and certainly the Clean Air Act, when fully in force, will bite on Government property as well as private property, and impose new requirements on the nationalized industries. I think in the first place of the National Coal Board's new duties in relation to colliery spoilbanks. I think of the Admiralty in relation to naval vessels. I think of the chimneys of Crown and Government premises of all kinds—I see that Professor Semple has obligingly illustrated one in his paper. I think of the British Transport Commission and the provisions concerning railway locomotives.

I could go on with this list for quite a time; but would refer to wider responsibilities which are connected with clean air, though they have other important bearings, responsibilities which the Clean Air Act has thrown into sharp relief. Availability of fuel for instance—the responsibility in the last resort of the Minister of Fuel and Power, but one in the discharge of which the concern of his colleague at the Ministry of Housing and Local Government with clean air, can never be left out of account.

The practicability of much of the domestic aspect of our Clean Air Policy depends on the supply, the price and the quality of smokeless fuels, and especially of the solid smokeless fuels. It is only logical that no fewer than a quarter of the material submitted to this Conference is concerned with smokeless fuels.

The Special Processes

I have not finished there. Since the first Alkali Act of 1863, the Alkali Inspectorate, which works under the Minister of Housing and Local Government, has been charged with the duty of ensuring the proper control of pollution from certain industrial processes, those processes which are liable to cause pollution of a particularly serious nature, but in which control is a matter of special technical difficulty. The Beaver Committee's recommendation, which the Government have accepted, that some further industries should be scheduled under the Alkali Act, has created a certain amount of controversy. It is but an extension of the same principle. The problem of the " special processes " is not simply one of enforcement—of seeing that a particular works complies with the general law; it is a question of devising and applying practicable means of reducing pollution to the desired level where special technical difficulties exist, not only at a particular works, but perhaps over the industry as a whole, wherever it is carried on. That will be the function of the Alkali Inspectorate, as regards the further industries which will be scheduled under the Alkali Act. The Minister will, in due course, make an Order for this purpose, after a public inquiry and consultation with the local authorities and other interests concerned. There is no need to regard this as a controversial matter or as a bone of contention between local and central government. Local authorities and the Alkali Inspectorate have worked in close collaboration with one another in the past. They will have concurrent powers under the Act in regard to smoke, grit and dust, and I have no doubt that harmony and collaboration will continue in the future.

The Clean Air Council

The Minister will shortly be proceeding to appoint the Clean Air Council under Section 23 of the Act, which, if I may quote the actual words of the Statute, is " For the purpose of:

(*a*) keeping under review the progress made (whether under this Act or otherwise) in abating the pollution of the air in England and Wales; and

(*b*) obtaining the advice of persons having special knowledge, experience or responsibility in regard to prevention of pollution of the air."

Thus the Council will be a consultative one. There have been suggestions in the past that it should be an independent authority wielding executive powers, but that would have been constitutionally unsatisfactory. It would have led to overlapping functions and would have impaired the Minister's responsibility to Parliament. The co-ordination of the work of the different Government Departments is the province of the Government itself, and could not properly be undertaken by an independent body. The Council will, however, work directly with the Minister—he will be its Chairman. It will comprise representatives of all the interests concerned in the prevention of air pollution—industry, local authorities and the fuel producers. It will provide a forum for the discussion of all aspects of the problem, and should exercise an important influence on the development of future policy and progress.

This brings me naturally to research and the future. I was bold enough, perhaps unwise enough, to say during the passage of the Clean Air Bill that I trusted it would not be the last during my Parliamentary lifetime.

Several known aspects of air pollution were left outside the Bill, not because Parliament failed to recognise their importance, but because, by the general consent of qualified opinion, legislation would be premature and impracticable in our present state of scientific and technical knowledge. Here I have in mind sulphur pollution, in some respects a more harmful pollution than the more visible and obvious pollution of smoke. So far as sulphur gases are associated with smoke, the Clean Air Act should automatically bring improvement, but a good deal, perhaps a growing amount of sulphur pollution not associated with smoke, will remain.

Then there is the whole question of fumes from motor transport, petrol and diesel. Here, again, we do not yet really know enough, either about the nature of the nuisance, or still less about methods of prevention, to be within sight of legislative control. But in regard to this and other forms of atmospheric pollution, the Government are not complacent.

Research and development work on this, and other air pollution problems, is being done by the Department of Scientific and Industrial Research, the Medical Research Council and by other bodies, such as universities and industrial research associations.

Incidentally, the D.S.I.R. Advisory Council has, until quite lately, been fortunate in having Sir Hugh Beaver as its Chairman. Among its other activities, the Fuel Research Station of the D.S.I.R. has been engaged on studying methods of reducing smoke from domestic appliances, the production of reactive coke at gasworks, and the various problems associated with pollution by motor vehicle exhausts. The Fuel Research Station has also been directly concerned in, and in a large measure responsible for, the development of the ammonia process of removing sulphur oxides from flue gases, which is now being tested at pilot plant scale by the Central Electricity Authority.

The Conference will be familiar with the comprehensive system of measurements of air pollution which is being carried out by a large number of local authorities and other bodies in co-operation with the Fuel Research Station. This work is of fundamental importance, since we must have accurate knowledge of the incidence and characteristics of the problem we are dealing with.

More than that, an efficient system of measurements and records will be indispensable in future in order to show the results obtained by our control measures.

Here again, in the kind of work which lays the foundation for future legislation, your Society is active. Your deliberations this afternoon, I notice, commence with two progress reports on the kind of matters I have just mentioned. And so I would end this brief review of the Government's concern with clean air by giving recognition to the importance of what

your Society does in this field, above all, by helping to create the indispensable foundation of all successful administration, an enlightened and enthusiastic public opinion.

The Meaning of 1(3) (d)

The answers to the questions on the Act put to the Parliamentary Secretary after his address added greatly to the value of the occasion. The questions and answers will be recorded in full in the "Proceedings," but we give here the answer to a difficult—and most important—question, which the meeting clearly considered to be the highlight of the session.

Mr. G. Nonhebel raised the point that in Section 1 of the Act, under the clauses for Defences, Sub-section 3, the Government had added a new paragraph 3(d), which read:

> "that the contravention complained of was due to the combination of two or more of the causes specified in paragraph (*a*) to (*c*) of this sub-section, and that the other conditions specified in those paragraphs are satisfied in relation to those causes respectively."

He asked if Mr. Powell could make clear to the Conference the meaning of this.

Mr. Powell: The sub-section in which the offending paragraph occurs deals with defences in proceedings for having emitted dark smoke. They are the defences with which, if the emitter of dark smoke makes good, he can get off. The first, (*a*), is that the contravention was solely due to lighting up, and that all practicable steps to prevent or minimize the emission of dark smoke had been taken. So that is one defence. If he uses that defence he must prove that there was no further cause at all but the fact that he was lighting up. He must prove that he has modern equipment, properly used, in a proper building; that everything else ruled out dark smoke, and that it was only, *solely*, because he was lighting up. (*b*), that the contravention was due to a failure which could not have been foreseen or, if foreseen, could not have reasonably been provided against. So, if the offender uses this defence, he must prove that everything else was right; that nothing within his control, or indeed outside his control, had gone wrong except that there was a failure of the furnace or the apparatus. He must rely entirely on failure, because the word is *solely*.

Under (*c*) the defence is in regard to unsuitable fuel. Now may I just pause for a moment to make this particular sentence clearer than I think it has ever been to a great many people who have criticized it. The defence here is not the use of unsuitable fuel. It is not a defence to say "I was using unsuitable fuel." The defence is to prove that the emission of dark smoke was due solely to the unsuitable fuel; that is to say, that the furnace itself was capable of being used without producing dark smoke—that it was a modern furnace, that it was properly operated, that it was in proper order. And not only that, but the defence must also prove that, of the fuel available, the least unsuitable was used, and that all practicable steps were nevertheless taken to minimize or prevent emission of dark smoke.

Thus, so far, the offender has got three possible defences. He can prove that the defence was *solely* due to lighting up, and nothing else; or he can prove that it was *solely* due to a mechanical failure and nothing else; or he can prove that it was *solely* due to unsuitable fuel in the circumstances and under the limitations which I have described, and nothing else.

And now, why paragraph (*d*)? Well, suppose you had to light up a furnace with unsuitable fuel. You'd be dished! You couldn't prove that it was due solely to unsuitable fuel because you were lighting up. And suppose there were a mechanical failure while you were lighting up? Washed out! There could be no

defence, because you could not make good that essential word, *solely*. Therefore paragraph (*d*) had to be inserted to make it possible to ensure that one of these " solelys " shouldn't rule out the other—that one defence which Parliament had thought good should not nullify another defence which Parliament had also thought good.

I am very glad to have had the opportunity of going through this clause because it has enabled me, not only on this point of detail, but I hope more generally, to show that these defences are in fact very tightly drawn indeed in the Act, to emphasize that the onus of proof is on the defender. It is he who has got to make good these defences—it is he who has to exclude all other causes and prove that, *solely* for the reason specified, dark smoke was emitted; and I venture to think that it is going to be very difficult indeed, and that the paragraph to which attention was drawn has only had the effect of making the Section in an Act of Parliament sensible instead of absurd.

No Chimneys

Our illustration shows one of an estate of new houses now being erected at Woking. Smokelessness is assured by the absence of chimneys. In other words, the houses are all-electric, and although this is by no means uncommon there are several interesting points about these houses. Space heating relies basically on " Thermovent " convector heaters of the inset type, all thermostatically controlled. In the sitting-room the heating is supplemented with an inset reflector fire, and oil-filled radiators are used in the bathrooms. Water heating, plus refrigeration, is effected by a Ferranti " Fridge-Heater," installed in a pantry designed to provide the 120 cu. ft. of cooled storage space required for efficient operation.

Insulation has been carefully watched. The houses have sealed cavity walls, the external walls being of stock bricks, and the internal of " lignacite " hollow pot thermal insulating blocks. The floor of each house is a concrete raft having an edge insulated, parquet wood block covering in all ground floor rooms apart from the kitchen, where Marley tiles are used. Upper floors are laid with tongued flooring, while the floor of the roof space is lined with fibreglass. At present single glazing is employed for the windows, but the use of a proprietary double glazing is envisaged for later houses. The main walls have a U value of 0·2, that of the " Lignacite " being 0·3. The lined ceiling has a U value of 0·15.

More details were published in *Electrical Times* for 8th November. The builders are J. Holmes & Sons Ltd., and the Woking district of the S.E. Electricity Board designed the electrical installation. A table of capital costs for the all-electric compared with conventional central heating installations shows a saving of £116. The cost in the electric house is given as £322, and for central heating (with chimneys and fireplaces) the cost comes to £458.

CLEAN AIR: THE NEXT CHAPTER

The Des Vœux Lecture at the Southport Conference, by Sir Hugh Beaver, it is hardly necessary to mention, was sound, pertinent and constructive. As it is reprinted in pamphlet form, as well as being included in the Conference "Proceedings," we are here extracting only a few of the more important points raised by Sir Hugh.

There is the "unsuitable fuel" defence of Para. 1 (3) (c). My Committee did not believe in the alibi, and I hope that it will not be able to establish itself as a routine defence. I suggest that there should be a testing station, or more than one testing station, available where any coal so pleaded would be tried out in sufficiently comparable, or at any rate fair, conditions. That would put the claim to practical trial, and I think it would not often be required.

In all this there is as I see it scope for a certain amount of co-ordinated thinking and some research and experiment on the part of the local authorities. I suggest that they should have a small Committee or Working Party of their own to draw up a code of practice for themselves. The more they agree on their attitude and practice the more powerful will be their impact.

This same body could study and agree for itself—though the final word does not rest with them—the standards that they feel should be adopted in regard to the heights of chimneys. There is scope too, I feel, for such collective thinking in regard to the requirement of Para. 3 that new furnaces shall "so far as practicable be smokeless when burning fuel of a type for which the furnace was designed." Even the most experienced of Smoke Inspectors and Borough Engineers may find this not always an easy problem; and what about the great number of smaller local authorities? There seems to me to be every argument for combined thinking and study of this sort by the local authorities. This would reduce duplication of effort and assist the less well equipped local authorities; for to a large extent the smaller local authority has not the technical means to carry out these tasks. Moreover if the local authorities are to be really something more than merely the Minister's agents, they must be fully informed technically and scientifically. Any action such as I have suggested is completely legalized by Para. 25 (1) (a) of the Act.

* * *

If it is the intention to secure the effective application of the Clean Air Act in 10 to 15 years, then, as has been pointed out over and over again, it is necessary to bring into operation smoke control areas in the so-called Black Areas at an average rate of something like 300,000 acres a year. As the start is bound to be slow and well below the average we must assume the normal sort of curve which would mean that from say the third to the ninth or tenth year from now new smoke control areas should be coming into existence at the rate of from 400,000 to half a million acres a year. This means the conversion of existing, or the provision of new, smokeless methods of space and water heating and of cooking in perhaps a million dwellings, shops, offices and buildings of every sort in a year, perhaps twice or more than twice that number of individual installations. If this is to be largely met by the use of smokeless fuel, coke and otherwise, as at the present stage of our knowledge it unquestionably must be, then it has to be produced of the right quality and at the right price at the rate of at least an additional million tons each year.

* * *

There is nothing in this that would

prevent the proposed Clean Air Council being what we intended, namely an influential, authoritative and informed body with power to survey the whole field. It will not as now established by the Clean Air Act be an independent body, but that may not matter since the members if they are the right people may be relied on to be sufficiently independent in the expression of their views and the use of their influence. But should it so turn out that the Clean Air Council fail to be that lynch pin and inspiration we contemplated, and fail to set the pace in all this work for clean air, then the responsibility will fall back once more on the enthusiasts and the crusaders who have all along borne the brunt of the battle. This therefore is no time to reduce interest or effort; for we come back to the point where we started, namely that success will depend on public pressure.

* * *

In some ways it is obvious that both the immediate objectives of your Society and your methods will be changing, and I imagine that you may well be contemplating some re-orientation of policy. If so, I think that you might find it worth while to have as one of your principal activities the collection of pertinent and striking information, and the feeding of it into the popular press in a form that can easily and readily be accepted and understood. This education of the people must include the removal of their doubts and suspicions, the dealing with criticism in a convincing and sympathetic manner, an honest interest in the public you are addressing, and an absence of self-interest or special pleading, and above all the presentation of real facts. Well now, whether that is something that your Society can tackle or not is for you to decide. What I am sure of is that this work should be done; and clearly it will not be in any way within the field of the Clean Air Council as contemplated. It must be provided in some other way.

The Smoke Inspector

We reproduce some verses, based on the Tit-Willow song in the "Mikado," written by W. Combey, C.P.H.I., for the City of Oxford, and read by him as the peroration to his paper on air pollution at the recent Bournemouth Conference of the Sanitary Inspectors Association.

On a chair in the Town Hall an Inspector wheezed
Oh pollution, pollution, pollution!
And I said to him Inspector why do you wheeze
Oh pollution, pollution, pollution!
Is it germs in the milk supply colleague, I cried,
Or some Chinese egg albumin in your inside?
With a shake of his poor aching head he replied—
Air pollution, air pollution, air pollution.

He slapped at his chest as he wheezed in that place
Oh pollution, pollution, pollution!
And a cold perspiration spread over his face
Oh pollution, pollution, pollution!
He coughed and he cried and a gurgle he gave
Then he slowly passed out did that Inspector brave
And an echo arose from his newly dug grave—
Air pollution, air pollution, air pollution.

Now I feel just as sure as I know that you hate
Air pollution, pollution, pollution,
Twas for love of his public he tried to abate
Air pollution, pollution, pollution.
And if you remain callous and obdurate, aye!
We shall perish as he did, and you will know why,
For we probably all will exclaim as we die—
Air pollution, air pollution, air pollution.

The Southport Conference

Reports and Comments by Two Delegates

1. *By a Local Authority Contributor*

One's first impression was that the weather could hardly have been less considerate to the hundreds of delegates who alighted upon Southport for this year's Smoke Abatement Conference. The northern resort usually enjoys a reputation as a solar paradise, but it had a nasty jolt during this week. A biting, howling semi-gale blew most of the time up and down Lord Street with the ferocity of a snorting dragon. A walk on the " Prom " was almost like passing through a wind tunnel. One felt in real danger of becoming air-borne! Showers of rain lashed down at too frequent intervals, but the covered verandahs fronting the shops in the famous tree-lined avenue, saved more than one individual from a soaking.

The brochure, sent to delegates beforehand, contained an imposing array of speakers drawn from local government, commerce and industry to initiate discussions. By and large, they ably fulfilled their tasks. It was only to be expected that the Clean Air Act would loom large in the proceedings, most of the sessions concentrating on its purport and implementation.

Mr. J. Enoch Powell, Parliamentary Secretary to the Ministry of Housing and Local Government, did a grand job with his lucid summary of the Clean Air Act, and an even better one when for some thirty minutes or more, he answered questions " off the cuff." His explanation of the contentious " escape clauses " in the Act, left his listeners almost speechless and a little wiser.

The Progress Reports, given on the Wednesday afternoon, were really divided into two distinct parts, and it was wise of the chairman to treat them so and split up the discussion. In the first part, two eminent medical men differed deferentially on dirty air and carcinogens in fumes from diesel engines. In the second part, speakers from two of the nationalized industries—Coal and Coke—extolled the virtues of each as *the* solid fuel *par excellence*. An interesting revelation was the announcement of a new free-burning smokeless fuel (Thermalite), developed by research workers of the North-Western Gas Board. It was claimed that it could successfully be burnt in any type of grate—a point of importance in view of large scale conversions which are contemplated in domestic grates.

One of the questions asked in Mr. Welman's paper (read in his absence by his Chief Technical Assistant) was whether coke was expensive, compared to other fuels. He suggested it was not, but the answer came at the close of conference when a resolution was passed urging the Government to secure the provision of smokeless fuels *at prices likely to encourage their use* Granting the point made in the paper that, weight for weight, there is more *bulk* in coke, this still does not explain to the man-in-the-street the reason for a seven-fold rise in the cost of this fuel over the past twenty years or so.

The discussion on the Local Authorities' part in working the Clean Air Act was a real Scottish/Lancastrian effort. With a Scot (John Innes) in the chair, and another (Professor Semple) giving a paper, ably supported by two speakers fra' Lancashire, what could go wrong? Nothing! Between them, they sorted out the problems confronting local authorities to such purpose, that subsequent speakers from the floor had their time at the

The Platform at the opening of the Southport Conference. The Worshipful the Mayor of Southport, Councillor F. E. Thornley, J.P., is speaking. In the Chair, on his left, is the retiring President, Sir Ernest Smith, followed by the Parliamentary Secretary, Mr. Enoch Powell, M.P., and the President-Elect, Dr. R. Lessing

" mike " cut to almost vanishing point. (Tailpiece: Professor Semple's coloured slides of Liverpool, shown with the help of his colleagues from the Health Inspectorate, and garnished with Scottish wit, rounded off a good effort.)

On Thursday afternoon we had " Housewives' Choice." A lady (Mrs. D. M. Charlton, B.SC.) took the chair and drew upon three other lady speakers who presented excellent papers. Mrs. Robert Courtney came from the Townswomen's Guilds to tell us her views about grates and prices of fuel; Miss Ledeboer, an architect, conveyed the architect's view of smoke pollution, while Miss Akester emphasized the trials of mothers trying to keep a clean home in a smoky atmosphere. There was enough "fuel" provided to keep speakers stoked up until the closure completed a good afternoon's work.

A regular feature of conference is the De Vœux Memorial Lecture which, each year, is given by an eminent person on some facet of smoke pollution. This year, delegates were privileged to hear Sir Hugh Beaver, K.B.E., Chief Architect of the Beaver Report, give what he described as his " swan-song "—a treatise on the next steps in the battle for Clean Air.

As a respite from the business side of conference and a counter to the inhospitable weather, the Mayor and Corporation provided a delightful evening's entertainment and dance in the Floral Hall, tastefully decorated for the occasion.

Altogether, a useful, stimulating and thought-provoking conference. Sufficient was said to let the bystander realize that this business of cleaning up the atmosphere is not going to be easy. There are numerous interests at

variance, if not in conflict, one with another, which need to be reconciled. The right type of fuel must be made available at the right price. Above all, public opinion must be so moulded that it will demand a cleaner and purer air and see that smog and its attendant evils are banished for ever.

2—By a Back-Room Boy

Those who attend conferences of the Society may be divided into two sections—those who have a background of science and technology who know what should be done and why, and those who have the administrative task of putting it into action. Local authority members, whether elected representatives or employees deal with human beings and meet at first hand their reactions to legislation, national and local; what is technically sound may not always be politically feasible. On the other side of the picture, what is politically acceptable may be unsound technically. The marriage of technology with local politics, curbing the impatience of the technical folk, while channelling administrative measures into what is technologically sound is one of the achievements of the Society, and a powerful reason for its continued existence. Conferences assist this process of mutual education.

Sometimes the back-room boys regard Conferences of the Society as a sort of *viva-voce* examination. They lean back to hear their pupils talk and try to detect how far their technical education has progressed during the year. Local government folk probably regard their technical colleagues in the same light and both derive much satisfaction from recorded " howlers."

Looked at from this angle, the conference was generally reassuring. It is true that a certain proportion of the speeches revealed the need for further education. One reflected, too, that those who spoke were the converted—indeed they were, presumably, the spearhead of the attack—and one wondered uneasily what was the state of technical education, and even the point of view of those fellow-councillors left behind to keep the home-fires (coal-fired!) burning in the Town Halls, while their colleagues spoke, sometimes with conviction, sometimes uneasily, of the reactions of their constituents to smoke-control areas. Even at this stage, after the Clean Air Act has become law, there was clearly some uneasiness about applying compulsion. The soundest remark on this subject was that the elected representatives must not neglect their duty to safeguard the health of their people. Small boys are made to wash behind the ear by compulsion.

A striking difference of opinion was revealed on the question of the price of smokeless fuel. Technological speakers envisaged premium fuels much more costly than gas coke. Some of the biggest cheers were drawn, however, by those who declared that smokeless fuels are too dear. One speaker in his enthusiasm even stated that " the cost of smokeless fuel is the only serious brake on our efforts to have clean air." Technologically, for complete downright rubbish that statement was hard to beat. But politically and sociologically it is defensible. The defence would rest on the common reaction of the man-in-the-northern-street who (as the Beaver committee said) regards coke as coal with the goodness taken out of it, and therefore thinks that coke should cost less a ton than coal. The answer is to tell local authorities that one of the major handicaps to living in their districts is the high rates, and demand that they be reduced by, say, 50 per cent. Their answer will be much the same as that of the smokeless fuel manufacturer to a demand for cheaper coke.

The fact that local authority speakers can stand up in public and repeat statements of the kind recorded in the preceding paragraph indicates that

education is still incomplete. Benjamin Disraeli once said that before he could carry a particular measure, he had to prepare the mind of the country and educate his own party. To change one word in another of his sayings, is it not true that " upon the education of the people of this country, the fate of the clean air policy depends "?

Two conclusions arise from this. The Society has had a lot of addresses on generalities in the supply of smokeless fuels, but cost of production is a subject from which nearly all authors shy. The incoming President may find it appropriate to arrange for a paper at the next conference which will examine the cost of production. The other conclusion is that a great deal remains to be done to educate the public on the use and value of smokeless fuels. The Clean Air Act in Section 25 gives local authorities wide powers to undertake and finance education and publicity. Some of the funds set aside for this purpose might with advantage be devoted to enabling the Society to enlarge its educational programme. The Society's most important work, as the President said in his address, is just beginning. Professor Semple gave an admirable object lesson on how to " soften-up " opposition to clean air.

An important and reassuring conclusion from Mr. Enoch Powell's address is that the Government are not half-hearted in their attack on air pollution. They will administer the Act firmly, and they expect every local authority to do the same. The next five years will see everyone concerned grappling with a host of problems, some administrative, some technical. Staffing problems will be serious, but it appeared that one solution is the appointment of more women as public health inspectors, not necessarily on the air pollution side. This back-room boy was rather alarmed by the light-hearted way in which sanitary inspectors (the term is used deliberately) seem to face the prospect of dealing with industrial problems in fuel utilization. How many have passed such elementary examinations as the City and Guilds " Boiler House Practice "? This, of course, goes almost no way towards securing the professional qualification of the Institute of Fuel which requires much more extensive knowledge. The solution may lie in the employment of part-time consultants, which some authorities have already adopted.

Some speakers seemed to mistake the conference for a meeting of N.A.L.G.O.; perhaps they had prepared their speeches for the N.A.L.G.O. Edinburgh conference and had failed to catch the Chairman's eye! Other speakers seemed to regard it as an advertising convention. The N.S.A.S. is not a professional body, but would it not be a good rule to permit in this connection statements, in papers but not in discussions, informing the members of genuine advances either in the type of fuels available or the design of appliances? For the most part, however, such statements would best be made in the Society's journal, after scrutiny by the editorial eye.

A tribute must be paid to the excellent organization of the conference by the Director and his staff.

New Appointments. Miss Mary George, M.B.E., has been appointed Director and Secretary of the Electrical Association for Women. Until recently she was Principal Information Officer of the Ministry of Agriculture, Food and Fisheries. Mr. Arthur Burton-Stibbon has been appointed Manager of the Solid Smokeless Fuels Federation. Formerly Regional Officer, London Region, of the Coal Utilization Council, he is a Registered Architect, a Chartered Municipal Engineer, a Fellow of the Institute of Arbitrators and has the Diploma in Administration (Engineering).

Both the E.A.W. and the S.S.F.F. are members of the Society, and we take this opportunity of extending good wishes to both their new chiefs.

The Avenue Carbonization Plant

To Produce Half a Million Tons of Solid Smokeless Fuel a Year

The Avenue plant, a couple of miles south of Chesterfield, is the National Coal Board's largest and most modern coal carbonizing and chemical plant. Although it has been in part operation for some months its completion was marked by an inauguration ceremony on 30th October, 1956, by the Rt. Hon. Aubrey Jones, M.P., Minister of Fuel and Power, whose speech at the luncheon which followed the ceremony was appropriately largely devoted to the clean air drive. An important point from it is referred to in our editorial columns.

The plant is alongside the main Sheffield and St. Pancras railway and must have been noted by those who have travelled on that line in recent months. It comprises, primarily, coke ovens which will carbonize 750,000 tons of coal a year, producing 500,000 tons of solid smokeless fuel suitable for domestic use. The coke, it should be emphasized, is for domestic and commercial purposes, and not for metallurgical work. 5,000 million cubic feet of town gas will be produced and that not required for firing the ovens is boosted to the mains of the East Midlands Gas Board.

The plant is fully integrated and is complete with its own breeze-fired boilers and electric power station, and the chemical side processes all the carbonization by-products—producing 6 million gallons of crude benzole, 13½ million gallons of coal tar, 18,000 tons of sulphuric acid and up to 12,000 tons of sulphate of ammonia.

The design is such that the works can be doubled in size in the future, and all equipment, buildings and so

on have been arranged so that this can be done without alteration to the original layout.

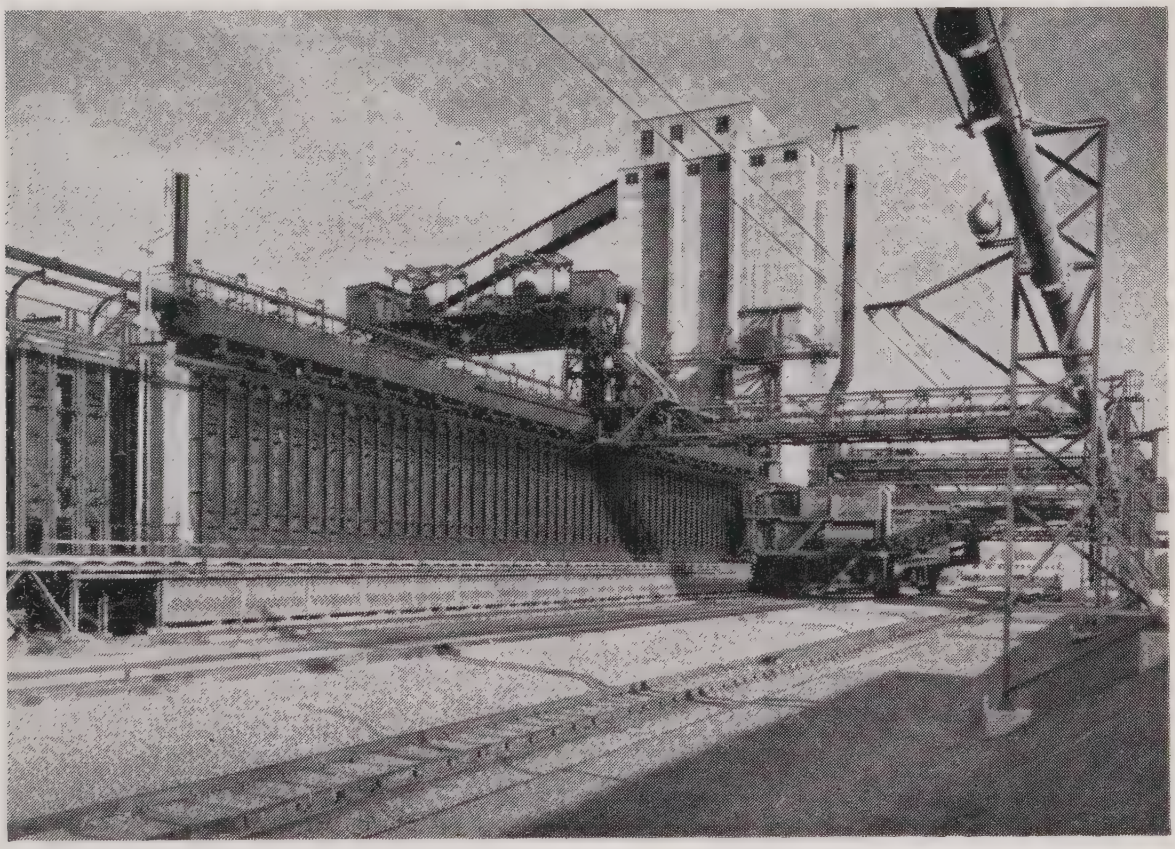
The coal carbonized is drawn entirely from a number of local collieries, and is of the lower rank types. An impressive feature of the plant is the building containing eighteen storage and blending bunkers, which have a capacity of 20,000 tons. From these the crushed coal can be blended as desired, and after a final crushing a system of belt conveyors carries the blend to the ovens' coal bunker.

There are two batteries of ovens, one of which has been working for some time, each containing fifty-three Woodall-Duckham Becker Combination Underjet ovens. They have a total daily coal carbonizing capacity of 2,175 tons. They are heated by either coke oven or producer gas.

After quenching and cooling the coke is taken by a system of belt conveyors to a series of screening stations, where first that above $2\frac{1}{2}$ in. is removed. The remainder is then graded into six sizes. Coke cutting machinery is provided and the whole of the coke can be made available in sizes suitable for domestic use. The breeze, together with breeze brought in from other carbonizing plants in the Division, is used in the boilers. The coke is mainly for use in domestic and central heating boilers and in closed stoves, although that of suitable size may be used in appropriate open fires.

Smoke Prevention

For the elimination of smoke the ovens are provided with self-sealing doors of new design, with collecting mains on both the pusher and coke sides. The attempt to prevent air pollution is in fact a praiseworthy feature of the plant, and from local observation there does in fact appear to be a negligible amount of smoke emission from any part of the works. There have been some complaints of fumes or smells—presumably from the chemical side of the plant—which it is admittedly difficult to eliminate completely in a works of this size and complexity, but as far as smoke is



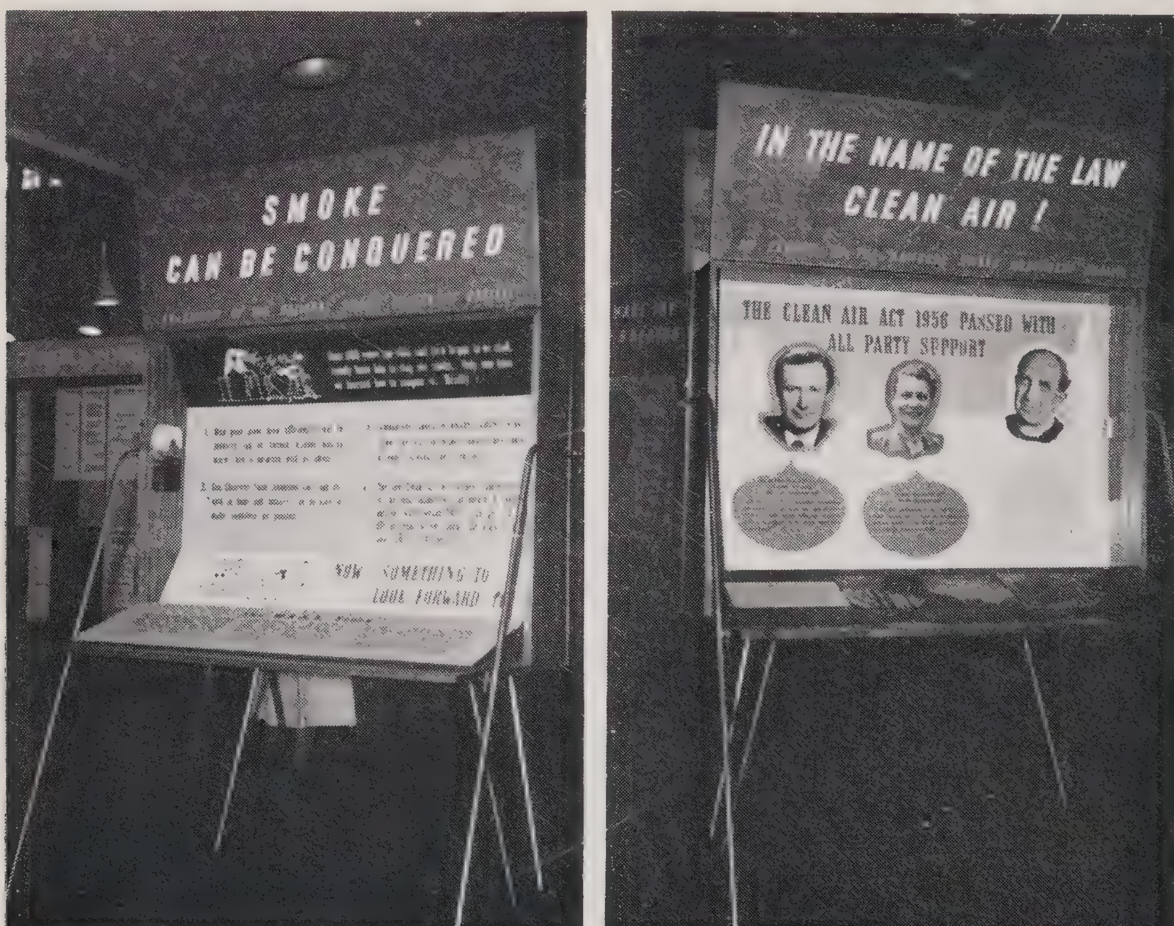
The Pusher side of the North Battery of Coke Ovens at the Avenue Plant, after six months in operation

concerned the ovens, so often a shocking source of smoke, seem to be remarkably good.

The Avenue works is so named because it is on the site of the disused Avenue colliery, which in turn was named, as an old map of the district shows, after an avenue of trees that ran across the site. The excellent descriptive brochure relates how " In these days when so much thought is being given to the problem of smoke prevention it is interesting to note the particular clause in the lease (negotiated more than seventy years ago) relating to the colliery, which permitted the erection of coke ovens

> ' to burn or convert into coke or cinders the said coal hereby demised . . . provided always that such coke ovens shall be constructed as far as possible to consume their own smoke.'

" Thus the Avenue plant of today perpetuates not only a name but also a tradition."



New N.S.A.S. Exhibits

Two of the set of four new portable exhibits now being used in the West Midlands Clean Air Campaign. Designed to give a quick message to the casual passer-by and yet something more informative for the interested, the stands are quickly dismantled and folded into boxes for carrying. The campaign in the West Midlands is going well, with excellent attendances and plenty of other local interest in the towns where the exhibition has already been held. After a flying start at Dudley, where the campaign was opened by Sir Hugh Beaver, the show has visited Darlaston, Stoke-on-Trent, West Bromwich, Halesowen, Wednesfield, Oldbury and Wednesbury.

THE ELECTRICITY AND GAS REPORTS

Reviewed by A. J. Cousin, M.Inst.F.

8th Report and Accounts of the Central Electricity Board, 1955-6

(H.M.S.O., 10s. 6d.)

This report of the Authority—including the Area Boards—indicates very clearly the progressive development of the electricity industry in England and Wales. On 1st April, 1955, under the Electricity Reorganization (Scotland) Act 1954, the South East and South West Scotland Divisions and the undertakings of the corresponding Area Boards were vested in a new statutory authority, the South of Scotland Electricity Board.

The rate of growth of the industry is indicated by the following figures:

During the year 1956-57, 75,000 million units were generated, 9·4 per cent. more than during the previous year. Consumers increased by 433,000 over the previous year, amounting to 3,345,000 since vesting day. The industry used 41 million tons of fuel, 6·6 per cent. more than in the previous year, but, as noted above, 9·4 per cent. more electricity was generated in consequence of increased efficiency of generation.

In spite of continued rise in cost of materials and services, the price of electricity has increased only by 2·3 per cent. over the price of the previous year, and only 22·6 per cent. above that of 1947-48.

The total revenue of the Authority and the Area Boards amounted to £380·46 million, producing a surplus of £12 million, making a total of surplusses since vesting date of £70 million. Capital expenditure amounted to £137 million in respect of the Authority, and £76 million in respect of the Area Boards.

The Authority possesses 276 generating stations. New generating plant brought into commission amounted to 1,622,000 kW. distributed among 37 power stations. At the end of the year, 29 new power stations, six new sections and 33 extensions, having a total capacity of nearly 12 million kilowatts, were under construction or planned.

The two experimental gas turbine generating sets at Trafford and Dunston A power stations have been in operation during the year.

Two hydro-electric projects received parliamentary sanction, a pumped storage plant of 300,000 kilowatts at Blaenau Ffestiniog and a conventional plant of 49,000 kilowatts on the river Rheidol.

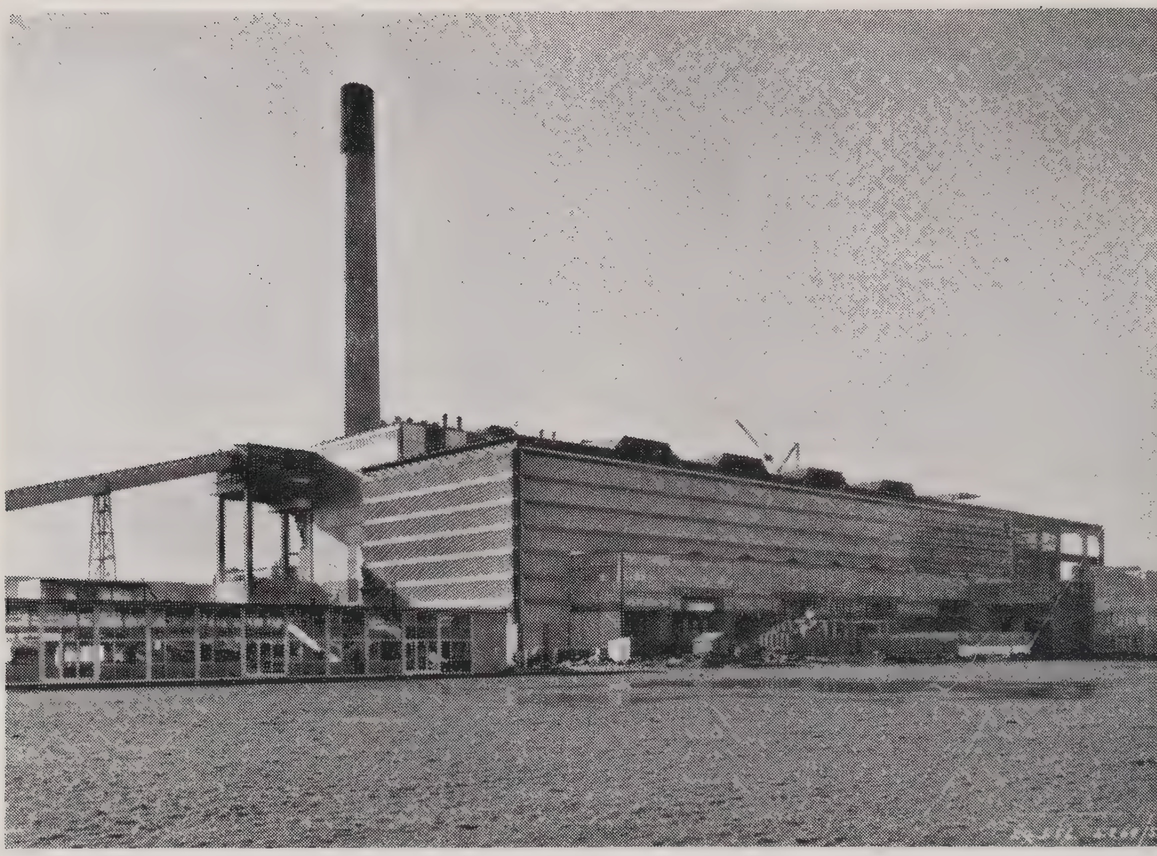
The overall efficiency of generation in steam stations increased from 23·83 per cent. to 24·35 per cent., corresponding to a saving in coal of 900,000 tons at a cost of £3·2 millions.

The Authority's grid comprises 197 route miles operated at 275,000 volts, 4,622 miles at 132,000 volts and 503 miles at 66,000 volts. The grid enables generation to be concentrated in high-efficiency plant—66·6 per cent. of the total output was generated in plant having an efficiency of over 24 per cent.

The percentage of plant out of commission during the critical winter months continues to decrease, and amounted to only 1·6 per cent. against 2·7 per cent. the previous year, and 4·1 per cent. in 1948-9. Load shedding was necessary only for a short period at the beginning of February.

Nuclear Stations

The Authority proposes to erect 12 nuclear power stations, and the sites for the first two stations have been selected at Bradwell-on-Sea, Essex, and Berkeley, Gloucestershire, where large volumes of sea-water are available for cooling purposes.



The new Marchwood Power Station, near Southampton, burns oil. The ultimate installed capacity is 480,000 kilowatts. The view shows the aluminium cladding, which is a feature of this station

In view of the heavy capital costs, nuclear stations advantageously fill the role of basic plant in continuous operation. Accordingly new plant at conventional thermal stations, even as large as the 200,000 kW. sets for the new 1,000,000 kW. station at High Marnham, Tuxford, are being designed so as to be capable of shift operation. This involves, inter alia, the provision of means for providing steam at sufficiently high temperatures at low flows to meet turbine requirements. The generators at High Marnham will be hydrogen-cooled in both stator and rotor, but other sets of similar capacity have liquid-cooled rotors.

Some six million tons of ash are produced annually, of which nearly half is fine ash from pulverized fuel fired stations. Experiments are being carried out with a view to its use in concrete aggregates and other building operations. It is proposed to pump the 300,000 tons of fine ash from the new station at High Marnham as a water slurry into a number of disused gravel workings five miles from the station.

Air Pollution

Consideration has been given to the prevention of atmospheric pollution, and measurement of dust deposit in the neighbourhood of power stations is carried out continuously.

The flue gas washing plants at Battersea and Bankside have been operated continuously, but with the process here used it is not possible to recover sulphur from the flue gases. Accordingly, an experimental plant, in which flue gases are washed with ammonia liquor with a view to the production of ammonium sulphate, is being constructed at Nottingham. The Authority is also examining dry methods of absorbing the sulphur, so that the flue gases can be discharged dry at high temperatures from the chimneys which in new stations will range from 400 to 500 feet in height.

The Authority has brought into

commission four new colliers, making a total of 51. The *Ferranti*, a 2,000 ton up-river collier, was lost on 8th June, 1955 in the Thames.

During the year, 14,666 additional farms were connected to the electricity service, making a total of 172,000 out of 272,000 farms in the Authority's territory.

At the end of March, 1956, the number of persons employed by the Authority (Headquarters and Generation Divisions) was 50,702, and by the 12 Area Boards, 130,221, making a total of 180,923, of whom 11·7 per cent. were women. Over 1,200 employees have enrolled for the Authority's first correspondence course for boiler house operatives, with a view to their taking the certificate of the City and Guilds of London Institute.

The Pimlico district heating scheme has been in operation for four years, and heat is supplied to 2,270 flats at the rate of 660 therms per flat. The general indication is that, with reasonably concentrated heat loads and a thermally efficient distribution system, domestic heating from back pressure turbines can be effected at a reasonable price.

* * *

7th Report and Accounts of the Gas Council, 1955-56 (H.M.S.O., 7s. 0d.).

This Report, which embodies those of the 12 Area Boards discloses the development of the gas industry since vesting day and the steps taken by the industry to meet rising costs of services and materials by increased efficiency.

In view of the difference in principle involved in the nationalization of the gas and electricity industries, it may be convenient to recall that the Gas Council is not a trading body and does not conduct any gas undertaking. The manufacture and distribution of gas is vested in the 12 Area Boards, themselves statutory authorities. The Gas Council is responsible to the Minister of Fuel and Power for the general direction and finance of the industry, and in its annual report it includes a survey of the activities of the Area Boards.

During the year the gross revenue of the industry was £346 million, of which £195 million was from sales of gas, and £105 million from sales of coke and some £45 million from other sources. After charging £30 million to depreciation and £17 million to interest, there remained a net surplus of some half a million pounds. Eight Boards had surpluses and four had deficits on the year's operations.

The industry used nearly 28 million tons of coal and produced 2,085 million therms of gas. In addition, 410 million therms were purchased from coke ovens, eight million therms from oil refineries, and some 30 million therms of water gas were manufactured. Since the end of the year, the North Thames and Southern Gas Boards have made arrangements for the supply of " tail " gases respectively from Shell Haven and Fawley, together equivalent to 350,000 tons of coal a year.

Efficiency of carbonization has increased from 71 per cent. in 1948 to 76·8 per cent. in the current year, equivalent to an annual saving of coal of some two million tons. Of the 1,050 gas-making plants taken over on vesting day, 362 were no longer in use, although overall production has increased by 20 per cent.

At the end of the year, the average revenue from gas was 18·5d. per therm as against 12·5d. in 1948. The price of coke has risen over the same period from 92s. to 170s. per ton.

Capital expenditure on additions to, or replacement of, plant amounted to £61·2 million. Under the Government measures to reduce capital expenditure, the programme for 1956-7 has been cut to £52 million.

Gas sold during the year went up to 2,648 million therms—industrial sales from 720 to 751 million therms, and commercial sales from 375 to 394 million therms. The number of consumers rose by some 130,000 to nearly 13 million.

Research

The Council continues its research into methods of gas production by

orthodox carbonization methods, gasification of weakly caking coals, the production of gas from oil and other materials, and of increased quantities of coke and of more active varieties to meet the demands likely to arise under the Clean Air Act. Attention has also been directed to the production of gas from coal or heavy oils at pressures of from 25-30 atmospheres. A plant for the hydrogenation of heavy oil to produce a million cubic feet a day is being erected at the Midland Research Station at Solihull. Search is being continued for supplies of natural gas in Sussex, Yorkshire and Midlothian, and in other areas.

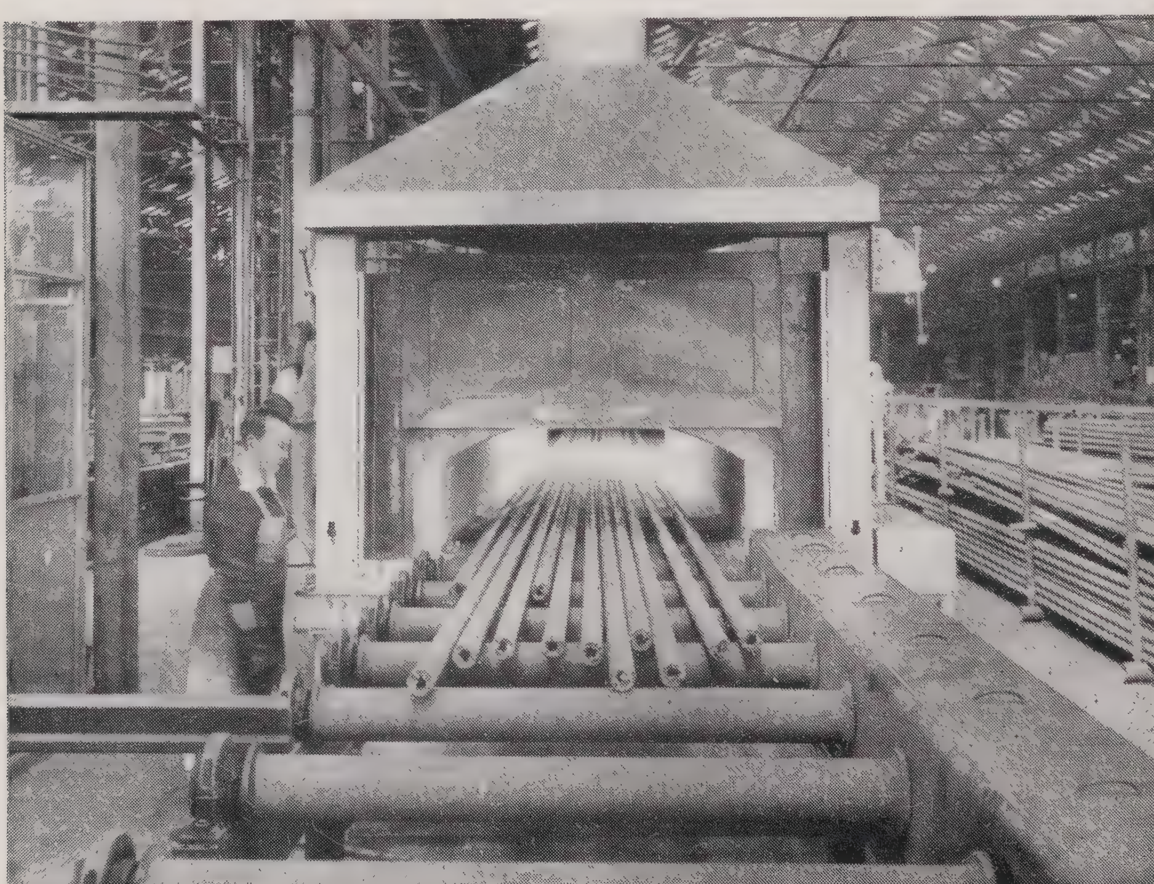
The Council is making every effort to increase coke production and to evolve other smokeless fuels to meet requirements of the Clean Air Act. The Domestic Coke Quality Committee and the British Standards Institution have under consideration a specification for domestic coke.

Attention is being directed to the conventional method of removing hydrogen sulphide from gas by contact with iron oxide. With a view to reducing the space occupied by the usual purifiers, experimental plants, in which the oxide falls in a tower in counter-flow to the gas, are under consideration. Methods of purifying gas, using liquid reagents, are being considered.

The Council keeps under review the efficiency of gas-using appliances and the behaviour, during combustion, of gas enriched by gases made by new processes, or by gases such as butane, that may be available to meet peak loads.

For industrial purposes a furnace capable of reaching a temperature of 1800C°., utilizing low-pressure gas has been constructed.

The number of persons employed by the Gas Council and the Area Boards was about 142,000, some 1,500 less than the previous year, brought about in some measure by integration and closing of smaller inefficient stations, but in part by the difficulty



A continuous roller hearth gas-fired furnace at Dumbarton

in some areas of obtaining labour.

In the area of the Northern Board, Rothbury has been linked to Alnwick by a main $1\frac{1}{2}$ in. in diameter, through which gas is transmitted at a pressure of 100 lbs. to the square inch.

The North Western Board has connected its plants in Liverpool and Birkenhead by a main over a mile long, laid through the Mersey Tunnel.

Two methods of producing solid smokeless fuel, other than coke, are being developed. One is carbonized briquettes, made from blended coal in vertical retorts. The other is produced from the carbonization of coal at low temperatures in continuous vertical retorts adapted for the Rochdale process. It is hoped to market both products in the near future.

In the area of the East Midland Board, the " backbone " main, to extend from Doncaster to Northampton, was completed with the exception of a link between Sheffield and Chesterfield, and a connection with Northampton. It is interesting to note that in this area 52·8 per cent. of the total gas available was taken from coke ovens.

The Wales Board completed a main from Connah's Quay to Caernarvon, crossing three rivers and reaching a height of 1,700 feet over Tal-y-fan Mountain. The same Board has made arrangements to take methane gas from Point-of-Ayr Colliery, and has installed a blue water gas plant for treatment of the gas.

The North Thames Board—as well as certain others—has made considerable progress in the installation of plant for the complete gasification of non-coking coal. It has also completed experiments on the production of a free-burning smokeless fuel from low rank coals in continuous vertical retorts, which is now on sale in the London area.

The South Western Board, by laying over one thousand miles of main, has been able to close 60—more than half—of its gas-making plants.

Property Owners and the Clean Air Act

The *Municipal Journal* raises an interesting point concerning one of the effects of the Act on property owners. Section 11 of the Act authorizes a local authority to make an order, subject to confirmation by the Minister, declaring the whole or any part of the area of a local authority to be a smoke control area.

Section 12 of the Act provides for the repayment by local authorities, by way of full or part reimbursement, of expenditure incurred in adapting the fireplaces of private houses. Under sub-section 2 the local authority has power to serve notice in writing on the owner or occupier requiring the carrying out of adaptations to avoid offending Section 11 of the Act.

The *Journal* points out that a conveyancing point arises here. A solicitor acting for a purchaser or a lender on mortgage has now to investigate whether any duty under such a notice lies with the prospective purchaser or borrower. There is no doubt that the legal profession is now aware of this point and it is understood that the Law Society is discussing with local authority associations an agreed form of question to be included in the set of questions which normally accompany a local land charge search.

This list of questions has in recent years become formidable and more expensive to the inquirer. It is necessary for them to be asked because of the growing complexity of local authority powers.

" The real question," continues the *Municipal Journal*, " is whether it is ethically correct to mulct the property owner into expenses which are necessary because of the section of local authorities in the exercise of their legal powers."

THE CLEAN AIR ACT AND INDUSTRY

At a conference held under the auspices of the Institute of Fuel in connection with the recent Fuel Efficiency Exhibition in London two papers were read on the subject of the Clean Air Act in relation to industry. Mr. W. B. Kennedy, M.Inst.F., M.R.S.H., Senior Smoke Abatement Officer, Manchester, put forward his viewpoint, and that of industry was given by Mr. W. J. Dickie, A.M.I.Mech.E., M.Inst.F., who is Technical Officer of the Federation of British Industries. We reproduce both papers.

I.—By W. B. Kennedy

Although to some extent the evils of smoke pollution have long been recognized, little progress has been made towards a wholehearted endeavour to obtain clean air in our industrial and residential towns. In a great measure this has been due not to lack of sufficient technical knowledge, but to apathy on the part of the public, local authorities, and government. It must also be admitted that certain manufacturers have not hesitated to oppose local authorities in enforcing the existing law, or to hinder the introduction of new legislation. In addition, the contribution of the domestic chimney has been largely ignored, and sponsors of smoke-abatement schemes have preferred to deal with the simpler problem of the industrial chimney and the efficient combustion of fuel in the boiler furnace.

It is now recognized that the domestic smoke question must be tackled, if smoke prevention is to be taken seriously. It presents a formidable obstacle. There is the natural resistance of the domestic coal-user to any interference with his most cherished centre of comfort—or ornamentation—the open fire. There is a lack of satisfactory alternative fuels at a suitable price; and there are the financial implications involved in installing appliances for burning smokeless solid fuels in place of grates suitable only for burning bituminous coal. To realize, however, the great change in outlook which has come about, one need only refer to the remarks of the then Secretary for Mines at the annual conference, twenty years ago, of the National Smoke Abatement Society. He said that the society must be careful not to condemn the use of coal by aggravating a social problem which existed in the depressed coal districts. The domestic consumer should have freedom of choice, he continued, and they should remember the importance of the domestic fire to the coal industry. They should do what they could to improve the conditions under which coal was used.

Although many local authorities have been lax in combating smoke pollution, it can fairly be claimed that the Corporation of Manchester has not been so. As far back as 1847, a special smoke inspector was appointed, and in 1881 the medical officer of health made a special report to the city council, in which he referred not only to the dense smoke emissions from factories, but also to domestic smoke which looked charming curling from a cottage chimney in the country, but was less agreeable as a constant haze in our streets. He mentioned that about 1841 he suggested that secondary air for industrial furnaces should be preheated, and constructed hollow fire-bars for this purpose. He claimed that he obtained good results on testing this, but had been too involved in medical practice to follow this up. A system of flue gas washing by an alkaline solution was introduced at a mill near Manchester in 1886. By 1881 additional smoke inspectors were appointed, and the permissible limit of black smoke was reduced to one minute in one half hour. This applied to all industries. In the meantime, smaller adjoining

townships were incorporated within the city boundary, and manufacturers protested that their trade would be driven away and the inhabitants left without means of subsistence.

In 1946 the Manchester Corporation obtained powers to attack smoke pollution by a method new for this country. Section 35 of the Manchester Corporation Act, 1946, gave the corporation authority to establish a smokeless zone in a defined area of the city, and to extend this zone, or establish others, after confirmation by the Minister of Housing and Local Government. In periods of acute shortages of fuels, materials and labour, precipitate action would have lost the goodwill of the occupiers, and accordingly the first smokeless zone requirements were not enforced until surveys had been completed, and assurances obtained that all necessary requirements could be met. The results were so spectacular that critics were silenced, and in response to demands by prominent citizens, the area was extended. In addition, several redevelopment areas have been declared smokeless zones.

Section 36 of the Manchester Corporation Act, 1946, requires that every newly installed furnace shall be smokeless as far as is practicable. It is obviously impracticable to formulate a rigid code of requirements applicable to every type of industrial furnace. A fundamental requirement, however, is that all newly installed furnaces for the combustion of bituminous coal shall be mechanically fired. It is not obligatory for plans to be submitted, but the smoke inspectors become aware of such schemes in various ways, and full collaboration from industrialists, consultants and architects has been obtained.

Whilst action has been taken on fuel and plant, the most important aspect, that of the training of stokers, has not been neglected. Classes for stokers have been conducted at the Manchester College of Technology for nearly fifty years, and great efforts are made to encourage attendance. Corporation employees engaged in the supervision or maintenance of boiler plant receive extra pay over the standard rate according to the grade of certificate in boiler-house practice which they hold.

In this very brief survey of Manchester smoke abatement policy in the past, I have tried to show that not only have penal measures been employed, but advisory work has also been maintained, and that the knowledge that a certain standard will be enforced by the corporation on all alike is an incentive to employer and employee to take an active interest in their fuel-burning plant. This necessarily leads to an interest in fuel efficiency, thereby assisting the national fuel economy, as well as making an increased contribution to public health.

New Duties

The coming into operation of the Clean Air Act will place many new duties on local authorities, many of whom, it must be admitted, never made any attempt to enforce the comparatively low standards of the Public Health Acts. Apart from local legislation, action in the main could be taken only against black smoke emitted in such quantity as to be a nuisance. What constituted a nuisance, or even what distinguished black smoke from other colours of smoke, was held to be capable of wide interpretation. Some progressive authorities, especially where the amount of work justified the employment of special staff, tried both to enforce the provision of the penal sections of smoke-nuisance legislation and to focus attention on the need for smoke reduction by continual visits from officers specially authorized for such work, who maintained a close contact with managements and staffs.

The most significant change in the general law is the ending of the need for smoke to cause a nuisance before action can be taken, and the enforcement of a much more stringent standard applicable to “ dark ” smoke as defined, instead of “ black ” smoke. Users of furnaces must use any practi-

cable means to minimize grit and dust emission, and there are special requirements regarding grit arrestors for pulverized fuel plant and furnaces burning solid fuel over a maximum quantity. New furnaces must be smokeless as far as is practicable, and notice of proposal of installation of new furnaces must be given to the local authority, subject to certain exemptions for furnaces designed mainly for use for domestic purposes. Regulations may be made by the Minister of Housing and Local Government regarding the provision of smoke recorders and the making known of such records, along with records of grit and dust emissions, to the local authority. In addition, the local authority will have power to require information about furnaces and fuel consumed in their districts. Smoke control areas may be established in which only authorized fuels may be burned, subject to certain exceptions. Grants may be paid from the local authority and the Exchequer towards the cost of adapting fireplaces in smoke-control areas. Legal action may be taken against smoke nuisances other than smoke from dwelling-houses, and dark smoke from a chimney of a building, or serving the furnace of a boiler or industrial plant, without the need to serve an abatement notice. Special industries will come under the jurisdiction of the Alkali Act inspectorate, and different standards will apply. A Clean Air Council will be set up to review progress, and for obtaining advice from persons having special knowledge, experience, or responsibility in regard to prevention of air pollution. Relatively high penalties may be imposed.

To make a success of this new measure, the following four points seem to be essential: (1) Trained stokers of recognized status. (2) Co-operative managements. (3) Sufficient number of competent smoke-abatement officers. (4) Active interest of local authorities.

In spite of many criticisms of the Clean Air Act, it must be admitted that it is capable, if enforced, of bringing about revolutionary changes in the air of our industrial and residential areas. Although there are loopholes, "escape clauses," and some lowering of standards compared with the Public Health Act, 1936, a very good case could, in common fairness, be made for such provisions. Instead of pleading that more and possibly unjust powers should have been granted, it is up to those whose duty it is to protect the public health to co-operate with our legislators by enforcing this Act. Whether or not all local authorities will do so remains to be seen. Unless sufficient numbers of technically qualified officers in this branch of environmental hygiene are appointed, and their work is supported, the Act will become a dead letter, and air pollution will remain a subject for dismal comment.

II.—By W. J. Dickie

Having heard the requirements of the Clean Air Act, many of you will no doubt be wondering how you can meet them. If you have formed the impression that they are onerous, I hasten to assure you they need not be so, because all the principles involved in the reduction of smoke and grit emission are well established. In the short time available I can give you only a brief outline of the practical steps you will need to take, and I propose to deal only with the small- and medium-sized boiler plants commonly used in industry.

The necessary modifications will vary with the type of plant and equipment. In the simplest form, they will involve little more than "putting the house in order"; in extreme instances it might be necessary to make major alterations, or even install additional plant.

I feel that the industrialist has received more than his fair share of criticism as a polluter of the atmosphere—the domestic consumer is a

much greater offender—but my experience shows that there is room for improvement.

The Act covers the emission of smoke, grit and dust, and I propose to deal first with smoke. Smoke is produced as a result of incomplete combustion of the volatile matter in fuel, and the cure is nothing more than the achievement of the conditions necessary to make it complete. These conditions are, briefly, ensuring an intimate contact with the correct amount of air, maintaining a sufficiently high temperature in the ignition zone, and providing a large enough combustion chamber to satisfy the conditions.

The most common cause of smoke is lack of the required amount of air. The theoretical quantity can be determined by the analysis of the fuel, but this cannot be achieved in practice and an excess is always present. In the interests of efficiency we must keep this excess to a practicable minimum, but ensure that the amount of air supplied is sufficient not only to complete the combustion of the carbon, but also to ignite and burn off the volatiles which are driven off. If the fuel bed is thicker than it should be, then insufficient oxygen finds its way through to complete the combustion of the volatiles, and smoke results.

It requires a skilled fireman to maintain the correct air/fuel ratio; a great deal of the smoke emitted arises from the employment of operators not acquainted with the basic principles of combustion. The training of operators must be placed high on the list of priorities.

Those of you who employ hand firing are likely to be among the first to attract the attention of the smoke inspector, and I strongly advocate a conversion to mechanical firing. Many types are available, all of them incorporating means of ensuring the correct distribution of the air supply and, provided they are properly operated and use the right fuel, they will ensure complete and smokeless combustion. Incidentally, they will also reduce your fuel bills by anything up to 20 per cent.

Certain types are more selective in the grades of fuel they require (I will deal with this at greater length later), and it is wise to consult the manufacturer on this point.

Where it is impracticable or uneconomic to install a mechanical stoker (as, in fact, seldom happens), then the smoke eliminator door designed at the Fuel Research Station will probably help. This was originally designed to reduce smoke from coal-burning ships sailing in convoy during the war, and it has since been widely adopted by industrial plants.

Smoke emission is sometimes attributed to the use of inferior fuel. We hear a lot about this, but there is no such thing as " inferior " fuel; what is really meant is fuel unsuited to the purpose. If, for example, a boiler plant is badly overloaded, it may only maintain the required rate of output even with fuel of the highest calorific value. The use of lower grades may in these circumstances result in the combustion chamber receiving more fuel than it was designed to burn efficiently, and combustion is therefore incomplete. It is most important to use the correct grade for the job, and your factors, or the National Coal Board, will do their best to obtain it.

Overloads are often the result of inefficiency in the use of steam in the process plant. When this is so, the cure should be sought in that direction.

The correct air/fuel ratio, and the best combustion conditions, cannot be achieved without the use of instruments. Draught gauges are essential to indicate the conditions in combustion chambers and flues, thermometers to show the temperatures of the flue gases, and a CO_2 or oxygen meter to show the results of the adjustments. Meters to register boiler output in terms of either steam or water are also valuable aids, quite apart from the need for them as the basis of a heat costing system.

Instrumentation

I cannot stress too strongly the importance of adequate instrumentation. During a recent tour of boiler plants in the U.S.A., in regions subject to strict smoke-emission laws, I noted that full ranges of instruments were always installed. A boiler-house without instruments is like a ship without a rudder.

The Act gives the Minister power to make regulations requiring the installation of instruments for indicating or recording smoke density. Quite apart from the legal aspect, a knowledge of the amount of smoke being emitted is valuable to the operator. These instruments, which have been on the market for some years, operate on the principle of measurement by photo-electric cell of the amount of light absorbed from a light beam by the smoke through which it passes. They can incorporate the means of operating a visible or audible alarm when a required maximum is exceeded.

You have heard that the Act also imposes restrictions on the emission of grit and dust. The means of compliance will, as for smoke, vary with the type of firing equipment, but the problem can also be tackled from the fuel angle.

The amount of solid matter, and the size of the particles lifted from a fuel bed, depend largely on the velocity of the air passing over and through it. An uneven fuel bed offers varying resistance to the passage of air, and more dust and grit particles are liable to be lifted from thin patches. Overloads which normally result in increased air pressures and higher velocities aggravate the condition.

It is therefore important to use the right grade of fuel. A high proportion of ash with a low fusion point will cause masses of clinker and unevenness; strongly caking coals form dense masses of coke, and smalls and fines, are more easily lifted. Mr. Karthauser said on the first day of this Conference that the proportions of ash and fines will increase in future, and these points should be clearly borne in mind.

With those types which sprinkle the coal over the fuel bed, and to some extent with hand-firing also, the finer sizes of the fuel are burnt in suspension. Most of the ash and grit particles become entrained in the flue gases; the heavier are deposited in the flues, and the lighter pass out of the chimney. The obvious remedy is to use a graded fuel free from fines, the type for which they were designed.

If dust and grit is still being emitted after the fuel and firing conditions have been corrected, it will be necessary to employ a suitable means of arresting it before it leaves the chimney. These means will depend on design of plant, nature of dust and grit, and amount of money available.

It is usual to define grit as the heavier or larger particles, the figure generally accepted being a diameter greater than 76 microns (0·076 mm.). The higher the gas velocity, the greater the size of the particle carried along, and a lot of grit can be made to fall out of suspension merely by providing a simple expansion chamber for reducing gas velocity. With a suitable arrangement of baffles, this can be very effective in collecting the larger particles, but lack of space often precludes its installation. A more compact and efficient means is the cyclone arrestor, which works on a similar principle. The finer dust particles can also be collected in a cyclone, but it has been found more effective to use a number of small units arranged in series.

To precipitate the very fine dusts, it is necessary to use an electrostatic type; this, although very efficient, is more costly, and is not usually justified for small plants.

It will be seen, then, that dust removal presents no problem as regards availability of equipment; all that remains is to decide which is the most effective for the conditions. Decisions will be influenced by amount of space available, power required for operation, and capital cost.

It has probably not escaped your notice that the Act gives a local authority power to require the measurement of dust and grit emitted from a furnace. It is to be hoped that this power will not be widely exercised, because accurate measurement is difficult. A British Standards Committee is at present trying to devise a standard simpler than the existing one, and more within the scope of a works staff; it will probably be based on samples drawn from the flue. It would be advisable, therefore, to provide for a suitably sized sampling point, and adequate means of access to it.

I feel sure that all industrial fuel consumers will welcome the Act as a means of correcting a social evil; nevertheless, they must be concerned with the cost of meeting its requirements. To a great many users it may prove a blessing in disguise by stimulating a more efficient use of fuel, and providing an opportunity to reduce manufacturing costs. Smoke and inefficiency go hand in hand.

SMOKE PREVENTION ABSTRACTS

264. Air Pollution as it Affects Forestry. Grayson, A. J. (Paper read to the British Assoc., Sept. 1956). The author points to the possible beneficial effects resulting from fertilization by additions from the air produced by man-made pollution, while admitting that in the worst instances the concentrations of the substances may become lethal or at least injurious. He describes how the depressive, destructive and disheartening effects of heavy smoke are brought home to the forester more than to other people. The author outlines possible censoring effect of pollution on certain species of trees, which thus alters pattern of woodland cover in parts of country which are badly polluted.

Many doubtful assumptions concerning the nature of effects and characteristics of species affected, are often made, and the author stresses the need to weigh and measure evidence. The most difficult aspect is the sorting out of pollution/exposure and pollution/fertility problems. Main silvicultural problems in the North-East are the conversion or reafforestation of existing woodland areas to produce the best stands able to yield useful returns in spite of the existence of pollution, and the decision as to the plantability and subsequently the choice of species in afforestation of bare land. After discussing various methods of measuring pollution and relating it to damage caused, the author concludes by discussing the effects of pollution on the fertility of the soil and the different techniques of management which may be necessary as a result of air pollution.

265. An Investigation into Bronchitis. Leese, W. L. B. (*Lancet*, Oct. 13, 1956, p. 762). Patients were interviewed to ascertain the age and mode of onset of the chronic bronchitis and the part played by some factors, including air pollution, in the development of the chronic cough. One hundred patients with chronic bronchitis and one hundred control patients were interviewed. The patients in the survey lived in North-West and West London, mainly in the boroughs of Willesden, Acton, Ealing and Wembley. Of atmospheric pollution as a cause of cough, it is stated that a significantly larger number of bronchitis (23:13) had lived within half a mile of a gasworks or power station for at least three years immediately before the interview. The general effects of fogs, and of the 1952 London fog in particular, are described.

266. Toxicity of Some Atmospheric Pollutants. Pattle, R. E., and Collumbine, H. (Brit. Med. J. Oct. 20, 1956, p. 913). In a study of potential atmospheric pollutants, the effects on animals of sulphuric acid mist, sulphur dioxide, smoke, mixtures of SO_2 and smoke, coal distillates, wood distillates, acrolein, and diesel fumes (under four different running conditions) have been investigated. The guinea-pig is very sensitive to sulphuric acid mist, but, apart from this, the concentrations of pollutants required to produce any effect on animals are very much greater than those found in smogs.

The effects of H_2SO_4 mist, SO_2, and a number of aldehydes on human beings have been studied. Sulphur dioxide in low concentration causes bronchoconstriction in certain cases; sulphuric acid mist can cause bronchitic symptoms, and is irritant in concentrations below 0·1

p.p.m. The toxicity of these compounds is annulled by ammonia. Some results obtained during the London smog of January 4-6, 1956, are described.

It is concluded that the toxic effects of smog are due to the action of small quantities of pollutants on exceptionally sensitive human beings; the substances concerned are probably, but not certainly, the sulphur compounds.

267. Studies of Sulphur-dioxide Concentration in the Neighbourhood of a Bituminous-coal-fired Power Station with very High Chimneys. Stratman, H. (Mitt. V.G.B. No. 40, 1956 (Feb.), 49-56. In German). Determinations of the SO_2 concentration at ground level around a power station with chimneys of 150 m. (490 ft.) height and an SO_2 emission of 0·84 to 1·02 tons/h, carried out over a year, have shown that the maximum concentrations were generally below 0·5 mg. SO_2 per cu. m., the limit above which damage to vegetation may occur. Very occasionally this maximum value was exceeded for short times. The maximum concentration was found at a distance of between 1,500 and 3,500 m. from the chimney base; the experimental values agreed well with calculated values. The SO_2 concentration varies in cycles with a maximum in January and a minimum in July. The measurements also showed that the increase of SO_2 concentration caused by industrial plants and populated areas is of the same order of magnitude as that caused by power stations. (B.C.U.R.A.).

268. A Recording Smokemeter. Jason, A. C. (Process Control Automat., 1956, (Feb.), **3**, 61-2). The potential difference between two photocells connected in opposition is fed, via an amplifier, to a servo-motor. The motor rotates an annular optical wedge placed in the reference light beam until the light transmitted to the reference photocell is the same as that transmitted through the smoke to the second photocell. (B.C.U.R.A.).

269. The Rise of a Hot Smoke Plume. Csanady, G. T. (Aust. J. Appl. Sci., 1956, (March), **7**, 23-8). Sutton's approximate solution for the path of smoke is simplified and expressed in non-dimensional form. The resulting equation is compared with the observations recorded by Bosanquet *et al.* It is concluded that a non-dimensional parameter—here called "Sutton number"—plays a role similar to that of the Reynolds number in pipe flow; at large distances from the chimney, Sutton's approximate solution is found to be accurate, but closer to the chimney a slightly modified formula should be used. From Author's Abstract. (B.C.U.R.A.).

270. A New Burner for Oil and Coal-dust Furnaces. Kuhlmann, A. (Z. Ver. Dtsch. Ing., 1956 (May 21), 837-9. In German). The new type of burner described has been in use for several years and gives complete and smokeless combustion. A device for mixing combustion air directs multiple air jets against the fuel jet to ensure that mixing with the atomized fuel (gas, oil or coal dust) occurs within the burner. (B.C.U.R.A.).

271. Instrumentation for Smoke Prevention in Small Boiler Plants. Glaysher, E. A. (Process Control Automation, 1956 (March), **3**, 95-100). Instruments suitable for use in a plant consisting of two Lancashire boilers are illustrated. Steam flow from each boiler is indicated; total steam flow is recorded; carbon dioxide is recorded; flue gas temperature is measured; draught gauges are provided. (B.C.U.R.A.).

272. Some Notes on the Clean Air Bill. Watts, A. J. C. (Refract. J., May 1956, **32**, 210-216). The salient points of the Bill are examined from the point of view of the ceramic industry. Section 13, which deals with the responsibility of the Alkali Inspectorate is particularly important. The industry has put forward a wider definition than that in the Bill for the ceramic works which are to come under the inspectorate, but opposition is expected from local authorities on the ground that it would diminish their power to control atmospheric pollution. (D.S.I.R.).

273. Clean Air Bill and its Technical Implications in the Refractories Industry. Rowden, E. (Refract, J., May 1956, **32**, 217-220). Boilers will have to be fitted with mechanical stokers. Coal-fired intermittant kilns present the major problem. Smoke from them can be reduced by control of the coal fired and the air supply, by mechanical stoking, and by firing with oil or gas, but it is preferable to change over to continuous kilns. (D.S.I.R.).

SMOG

In the House of Commons, on 30th October, 1956, Mr. Dodds asked the Minister of Housing and Local Government what progress had been made in protecting the people against the harmful effects of smog this winter; what Government departments were co-operating; and in what way the public, local authorities, radio and television services were co-operating.

Mr. Sandys circularized, *in Hansard*, the following reply:

The only sure protection against the ill effects of smog is prevention of air pollution. This cannot be accomplished all at once, but will require a sustained effort by all sections of the community over a number of years.

Since last winter, progress towards this objective has been marked by the passing of the Clean Air Act, which provides the legislative framework for an intensive attack on pollution by smoke, grit and dust from all sources. Government Departments and other bodies concerned, including the Medical Research Council, the Department of Scientific and Industrial Research and the fuel industries are actively co-operating.

An Order under the Act will shortly be laid before Parliament specifying the appointed day for those provisions which relate to smoke control areas, new furnaces, the height of chimneys, the appointment of Clean Air Councils, and certain other matters.

It is intended that the remaining provisions of the Act, which deal with emissions of dark smoke, grit and dust from industrial premises, railway engines and vessels, should be brought into force in the early part of 1958.

Meanwhile, arrangements have again been made for warnings to be broadcast by the B.B.C. this winter, if and when persistent fog is forecast, with advice to the public about the steps they should take. Householders and industry will be asked to take special care to minimize smoke during periods of fog.

From our Photo Library No. 27 *A. M. Carlsson, A.R.P.S.*

Neighbour's Offensive

THE TWO SIDES OF THE ATOM

THE photograph above* has a symbolic appeal that should be appreciated by readers of this journal. It is a stone age circle, some 4,000 years old, with the great new Calder Hall nuclear power station in the background. The men who built the circle had discovered that mysterious, powerful force called fire, and had learned that they must control it with care or it would get out of hand and might easily destroy them. Today we are learning how to harness a far more mysterious, far more powerful, force. As with fire, this may, according to our wisdom, be of the greatest good to mankind; or it may be more destructive than the fiercest conflagration. Both sides of the picture are of importance to those who are concerned with the state of the atmosphere in which we live.

On the one hand the harnessing of the atom in power stations, as at Calder Hall, is a process for obtaining energy in a way which, unlike the combustion of any of the fossil fuels, adds no pollution to the air. The dangers that could occur are such that they must be totally prevented. There can be no " best practicable means " loophole with respect to radiation or radioactive effluents from a nuclear power station, simply because it would be too dangerous to risk even the smallest loophole. Those who may be anxious about the new nuclear

* The photograph is reproduced by courtesy of the *Manchester Guardian*, in which it was first published.

stations may rest assured that here, as with hydroelectric stations, there is a means for procuring energy that is free from harmful bye-effects.

The energy, released from the nucleus of the uranium atom in the form of heat, is used to generate electricity in virtually the same way as the heat generated from the burning of coal. The only essential difference between the nuclear and conventional power station is the source of the heat to produce the steam which, through turbines, drives the dynamos which generate the current. The advent of nuclear energy thus affects electricity generation and supply only at the beginning of the process, and does nothing to alter the problems and economics of distribution, load factor and the like.

Given a peaceful, stable world it seems inevitable that the future will see an abundance of nuclear energy, polluting the atmosphere neither in production nor use. But it will take many years to replace the coal and oil stations. The first phase, and even this will take time, will be for the new stations to cope with the *additional* energy needs that are estimated. Thus the Government White Paper of 1955, *A Programme of Nuclear Power*, proposed the building of 12 nuclear stations to be in production by 1965. These would produce power to the equivalent of five or six million tons of coal. If all went well, the next stage of development would be to produce, by 1975, power equivalent to 40 million tons of coal. This would cover the present consumption of coal for electricity generation, but it is estimated that this will increase by six to seven per cent. each year, so that even twenty years hence a substantial part of our electricity must continue to be produced from coal—or oil.

How far nuclear power will, in due course, replace our present-day fuels can only be a matter of speculation. The whole thing is still in its infancy, and we do not know what revolutionary processes and techniques may come. But the load factor will remain one of the vital elements of the economics of nuclear power as it is of present practice. The most obvious example is the domestic winter space-heating load, which has to be capable of meeting short, abnormally high peaks that may occur only once or twice a year. The investment that would be required to erect stations that would in effect be used only for these brief periods might well prove to be impracticable for even the wealthiest nation. The atom will not solve problems of this kind, at least with our present knowledge, and the end of solid fuel is nowhere in sight.

Thus the bright side of the picture of the atom is doubly beneficial to our objective of an atmosphere free from all preventible impurity, but it cannot, by itself, provide the complete answer to our problems.

The Other Side

The other side of the picture is dark. It is the shadow of nuclear explosions. The effects of these if used in war are quite outside our scope, and will not be discussed. It is however a matter of concern to the movement for clean air that the consequences of test explosions should be kept under careful review. How safe, or how dangerous, are these tests, especially those from hydrogen bombs, and to what extent may they be continued without danger?

There has been much disquiet, and it is not entirely removed by two reports that have recently been published, reassuring though they may be on the whole. One of these is **The Hazards to Man of Nuclear and Allied Radiations:** a Report of the Medical Research Council. (H.M.S.O., 5s. 6d.). The second, which is a text-book rather than a report, is **Nuclear Explosions and their Effects,** from the Defence Science Organization, Government of India. (Publications Division, Ministry of Information, Delhi, 7s. 6d.).

The Indian report covers the effects of nuclear explosions only; the British discusses these major matters as well

as other forms of radiation to which man is exposed—such as natural radiation, cosmic rays, that from industrial sources, and from other specific applications.

The test explosions, carried out so far only by the U.S.A., the U.S.S.R. and Britain, are conducted, for obvious reasons, under strict control. That is, as far as the local consequences are concerned. They give rise however to radioactive particles that are dispersed into the atmosphere and then gradually settle out in what may be literally a *global* fall-out. In general, as the Indian report states, about 50 per cent. of the fission products of a high-yield explosion go into global fall-out. This is deposited, more or less uniformly, over the entire surface of the earth, at a gradual rate, beginning a few weeks after the explosion and extending over a decade or so.

Dispersed throughout the atmosphere, and falling out so slowly that accumulation is improbable, the amount of radioactive fall-out is at present only a small fraction of what we receive (and always have received) from natural sources and from the cosmic rays that bombard the earth from space. The British report states that " the present and foreseeable hazards from *external* radiation due to fall-out from the test explosions of nuclear weapons, fired at the present rate and in the present proportion of the different kinds, are negligible."

Nevertheless, there are potential dangers. There are two main types of hazard from fall-out. One is the genetic effect: radiation which does not affect the health of the individual but may affect the genes he passes on to his offspring, giving rise to mutations. Mutations have at all times occurred and some are induced by natural radiation. The greater the radiation received the greater the chance of a mutation occurring. It is stated that the genetic effects to be expected from nuclear test explosions at the present rate are insignificant, although this might not be the case if the present rate of firing was increased or if a greater number of thermonuclear weapons were tested. The basic fact is indicated by the statement in the British report that:

> " the rise in mutation rate is probably directly proportional to the amount of additional exposure to radiation, and any additional exposure, however small, must be expected to raise the mutation rate, if only by a minute amount."

The other hazard is to the health of the individual himself, mainly as a result of absorbing into the body radioactive strontium, which is invariably found in the fall-out. Strontium is an element similar to calcium, the important substance making up the bone of animals, and it is able to follow, as it were, calcium into the bone and to remain there. Radiostrontium fixed in the bone may, in the course of time, set up serious effects. It is not taken into the body directly, as a rule, but is absorbed in the first place, by plants and herbage that become foodstuffs or are grazed by cattle. The radiostrontium content of our bones is already increasing, and at a more appreciable rate among children and young people, but is still only one-thousandth of the permissible occupational level. The British report considers that the position should be carefully watched and that it would require immediate consideration if it rose to much beyond one-hundredth of the permissible occupational level. The Indian book suggests that:

> " The estimate of radiostrontium hazard is beset with many uncertainties and difficulties. All the same, it is apparent that it constitutes a danger to which the most careful attention must be given. It is a subject which deserves and demands a serious and sustained study on a world-wide basis."

Of the two volumes, the British report is the more authoritative and more concentrated, with a large and weighty B.M.C. committee behind it. The Indian book, on the other hand, is a departmental study that, while

losing nothing of its careful scientific approach and balanced judgment, possesses a lucidity and an undertone of anxious sincerity. It is as if the authors remained aware, throughout the book, of how all humanity depends, perhaps even for its continued existence on this planet, on our ability to understand and control the new forces we have discovered and with which we are so boldly juggling.

The problem raised by the test explosions can be summed up thus. As far as we are aware the present hazards are negligible, but might not be so if the tests continue too long or become too frequent. But are we sure that we know all there is to know about the problem—about possible indirect effects, or about effects that may not yet have become apparent? The answer is that we are not sure, and that the only thing to do is to halt the tests as soon as possible.—*A.M.*

DIVISIONAL NEWS

At a meeting of the **Yorkshire Division** of the Society on 5th November, the chair was taken by Mr. A. C. Saword, Chairman of the Division. The meeting was held in Bradford Town Hall.

Mr. J. Ruscoe, Bradford's City Treasurer, gave his estimates of the cost of establishing smokeless zones. Mr. Ruscoe based his estimates on an area of 6,431 houses and stated that the local authority would have to pay £95,000 to convert this area, taking loan charges into account. A very low figure for the average cost of each house had been taken, he said, and on each conversion the local authority would have to pay 30 per cent. of the total cost. He pointed out that in some cases gas or electric cookers would have to be installed and this would increase expenditure, but, if the scourge of a polluted atmosphere was to be removed, then the necessary action was bound to cost money.

Dr. John Douglas, Bradford's Medical Officer of Health, said that in the last twenty years Bradford had been trying to get rid of its smoke pall, and in that time there had been an improvement of one-third.

Speaking at a meeting of the **East Midlands Division** on 8th November, at North Wilford Power Station, Notts., Mr. O. S. Woods, chief generation engineer of the Central Electricity Authority, said that one of the biggest problems of a modern power station was the disposal of ash. About 10,000,000 tons of fuel were burnt at the power station each year, he said, and a sixth of that became ash. The normal way was to dispose of it in " lagoons " but other ways were now being found. Pulverized fuel ash was now used in concrete mixtures, and it was also possible to oil-fire pulverized fuel into a lightweight ash in big demand by the building trades.

Delegates met at the Guildhall, Nottingham, in the morning and were taken on a tour of the smokeless area at Clifton. After lunch they went to Wilford and after the address by Mr. Woods they toured the power station.

Housewife the Worst Offender

Mr. G. W. Farquharson, a Vice-President of the Society and Secretary of its West Midlands Division, speaking to a meeting of the Womens' Standing Conference in Birmingham, said that in the midst of the city's heavy industry one of the worst offenders against clean air was the housewife. Every year in the city three million tons of raw coal were burned by industrial and domestic users. Often the domestic user was the worst offender for unlike industry, few of the gasses and carbon deposits, were removed in the burning. On Sundays air pollution was as great as on any other day, Mr. Farquharson told the meeting.

The Standing Conference is deeply concerned about the health aspect of smoke abatement and in April they will help to stage an exhibition in connection with the West Midlands Campaign.

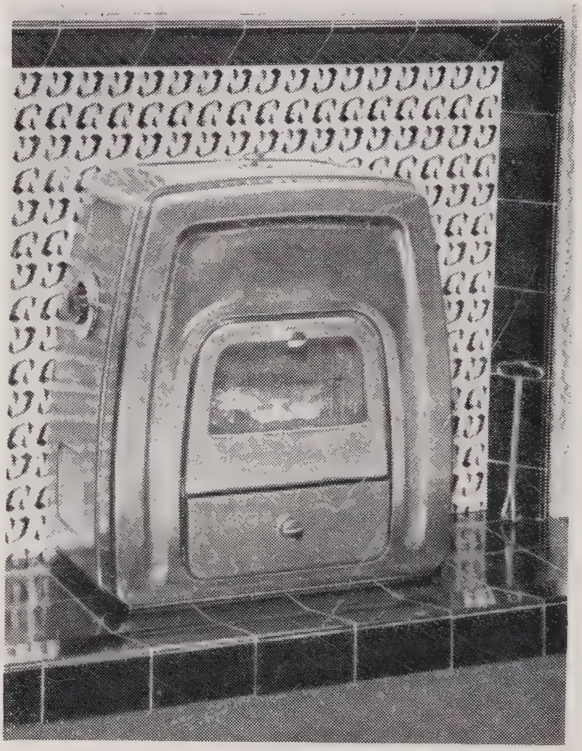
SHEFFIELD UNIVERSITY COURSE ON A.P.

A remarkably successful residential course on air pollution was organized by the Department of Extramural Studies, University of Sheffield, in co-operation with the Yorkshire Council for Further Education, and held on 25th to 27th September last. For a three-day course a registration list of over 150 names was very impressive. The majority of those attending were from industry, but there was a sprinkling of Public Health and Smoke Inspectors. Professor Thring was director of the course and Dr. P. H. Price its tutor.

Thirteen papers in all were read, covering the ground pretty thoroughly. In the first session Mr. G. Nonhebel discussed the nature and characteristics of air pollution and a paper by Dr. E. T. Wilkins dealt with its measurement. Two papers dealt with some of the consequences—health and the effects on vegetation by Dr. J. Pemberton, and the effects on buildings and metalwork by Dr. R. J. Schaffer. The dispersion of gases was the subject the following day, of a paper by Dr. A. Garnett, who dealt with the geographical factors, and Mr. C. H. Bosanquet, on the flow of chimney gases.

The next session saw papers on domestic heating and the measurement of smoke in chimneys, both by Mr. W. F. B. Shaw, and one on vehicle exhausts from Dr. A. Fitton. On the final day Professor Thring himself dealt with metallurgical smoke, and Mr. J. W. Batey with industrial boilers. In the last session, "Grappling with Air Pollution," Mr. Batey read a paper on the industrial aspects of the Clean Air Act, and the history, development and principles of air pollution legislation was examined in a paper by Mr. Arnold Marsh.

The possibility of publishing this series of papers, which together make an up-to-date text book, perhaps with the co-operation of the Society, is being discussed. We should be glad to hear from readers who would wish to purchase copies if it should be agreed to proceed with publication.



THE ESSE AUTOVECTOR

We illustrate the new "Autovector" stove which has a number of interesting and novel features. First, the heating rate is controlled by means of an adjustable thermostat which then automatically regulates the air input required to maintain heating at the set rate. The fire panel, which is cleansed and protected on the inside by a secondary air inflow, is made of strips of clear, heat-resistant *glass.* The fire is fuelled from the top—the mesh convector cover at the top of the stove lifts off, and a fuel-door beneath it opens to give direct access to the fuel storage hopper. The fuel can simply be poured in from a hod. It drops down gradually from the hopper to the combustion zone beneath.

With an attractive design and finish, these and other features make the Autovector a stove of note. It is manufactured by Smith and Wellstood Ltd., of Bonnybridge, and is priced at £28 10s.

Smoke Control Areas

This article was included in the " Clean Air " Supplement of the Journal of the Leeds Chamber of Commerce, for which it was written by the Director of the Society. It is reproduced here by arrangement with the Journal and is also available from the Society, in pamphlet form, at 2d. per copy (by post, 4d.), or 2s. 0d. per 12, or 12s. 6d. per 100, postage included. The Leeds Journal " Clean Air " Supplement is an extensive and useful survey of the Clean Air Act and its implications, mostly in the form of articles of a technical nature on the industrial aspects, on which its Editor and the Chamber of Commerce are to be congratulated.

THE new Clean Air Act, in addition to strengthening control over industrial smoke, is the first general law to provide for the prevention of smoke from domestic houses. This will be done through the establishment of smoke control areas, which may or may not be the same as the more familiar smokeless zones, a number of which have been established during the last few years by municipalities which have secured the necessary powers in local Acts.

Before describing the new legislation and the nature of the proposed smoke control areas, it may be helpful to indicate why this apparently piecemeal kind of approach to domestic smoke prevention should be necessary, when, as it is now agreed, such smoke is responsible for a great deal (roughly one-half) of the harm done by air pollution, so that clean air cannot be secured unless this problem, as well as that of industrial pollution, is solved.

It is, in fact, a more complicated problem than that of industrial smoke, for the latter can be prevented by making use of available improvements and improved techniques in the burning of coal, whereas the only way, so far, of eliminating domestic smoke is by ceasing to burn raw coal. This will entail a vast change-over from coal fires to the smokeless mediums—gas, electricity, oil and the solid smokeless fuels. For several important reasons, including a deeply-rooted tradition and the heavy peak load during severe wintry weather, we are obliged to depend, and will have to do so for a long time, on solid fuel for a large proportion of the heating needs of the home.

If a clean air policy is to be implemented, there will have to be very big developments in the production of solid smokeless fuel, which, for the whole of the country, could not be completed in less than, at the best, two or three decades.

Slow progress towards smokelessness could be made, therefore, over the country as a whole, or, alternatively, there can be much more rapid progress, which can begin at once, if the districts that need clean air most urgently are given priority. These areas, where pollution is heaviest and the dangers of smog are greatest, were aptly called the " Black Areas " by the Beaver Committee.

It was the recognition of this problem which led the National Smoke Abatement Society, in 1935, to propound and develop the idea of smokeless zones: areas, that is, where all smoke is prohibited. Such areas, it was pointed out, need only be small to begin with, but could be expanded, stage by stage, until in due course the whole of a town or district became smokeless. The acceptance of this principle made rapid progress, and the first legislation to make smokeless zones possible was included in the Manchester Corporation Act of 1946. A score of other authorities have since

then secured similar powers, and smokeless zones have been set up in Coventry, Manchester, Rochdale, Bolton, Salford, Bradford, Tottenham, and the City of London. In the last case the whole of the City area is the smokeless zone.

The experiment has proved most successful—Manchester's zone, for example, has been extended once and a further extension is scheduled. It was not thought that, in themselves, the first small zones would give substantially cleaner air to the area, because of the drift of smoke from outside. The improvements that have been observed have, in fact been greater than were anticipated. These first smokeless zones have largely been confined to residential and " commercial " (shops, offices, hotels, etc.) districts, and few industrial premises have so far been included. Complete smokelessness in such areas can easily be attained by the use of smokeless fuels and mediums, or, in the case of coal-burning plant for large-scale central heating, by the use of underfeed or other mechanically-stoked furnaces. If, however, the zones are to expand, they must sooner or later include industrial installations where raw coal has to be burned on a much larger scale. Technically and economically it may be impracticable to change such plant to any of the smokeless fuels. It should, however, be possible, in any industrial plant, to burn raw coal smokelessly, or with only a negligible emission, and it is much better that this should be done than solid smokeless fuels should be diverted from the domestic market, where they take the place of coal that cannot be burned without smoke.

The words used above, " a negligible smoke emission," are important. Even with the most modern and best-run plant, a little light smoke is at times unavoidable, and a slight haze may in fact accompany the highest combustion efficiency. For all practical purposes such smoke can be tolerated, and is, in fact, allowed in the new Act. But it can hardly be allowed in a smokeless zone without making nonsense of the phrase. It was for this reason that the Beaver Committee proposed the term " smoke control area," and it is this name that will be used in the new Act. This gives powers to local authorities to establish, by an Order, smoke control areas, the precise nature of which may be varied according to the requirements of the Order. A smoke control area may be a smokeless zone in the fullest sense, or it may exempt, or prescribe special provisions for, specified premises or classes of buildings.

As far as domestic premises are concerned, however, it will in all cases require smokeless methods of "authorized" fuels to be used. Fuels listed as authorized will in fact be the solid smokeless fuels—anthracite, Welsh steam coal, gas coke, hard coke, and the processed fuels known by their trade names, Phurnacite, Coalite and Rexco.

The Legal Procedure

The process of establishing a smoke control area and indicating what is required may be shown by summarizing the main points of the relevant clauses of the Clean Air Act—sections 9, 10, 11 and 12.

Any local authority may declare a smoke control area, subject to the confirmation of the Order by the Minister. Apart from any specified exemptions and limitations, it is an offence for any smoke to be emitted in the area. The penalty is a fine not exceeding £10. It is a defence if the smoke is due solely to the use of an authorized fuel. The point of this is that a smokeless fuel might on occasion contain material that would give rise to smoke, for which the user could not fairly be blamed.

The order may make different provisions for different parts of the area, may apply only to specified classes of buildings, or may exempt specified buildings on specified conditions—a building, or class of buildings, for example, might be exempted for a given period. This provision gives a

wide degree of flexibility to the principle, so that local or temporary conditions can be allowed for.

A further provision gives the Minister power to exempt any class of fireplace if it is of a type that allows coal to be used without, or without a substantial, emission of smoke. This is to meet the possibility of a smoke-reducing domestic appliance being developed which could be used with virtual smokelessness.

The details of the procedure to be followed in proposing and establishing a smoke control area, such as advertising the proposal, allowing for objections and, if necessary, an inquiry, and so on, are included in a schedule to the Act, and follow lines similar to those included in the recent local Acts.

The Act continues by providing that the local authority may make a grant, in respect of private dwellings, churches and buildings used by charities, etc., for the cost of adapting fireplaces, etc., to enable them to comply with the requirements of a smoke control area. The grant may be anything between seven-tenths and the whole of the cost. If it should be necessary, the local authority may order the necessary work to be done, or carry it out themselves, in which case they can recover up to three-tenths of the cost. The local authority may in turn claim from the central Government four-sevenths of what they have paid out* in respect of privately-owned houses and two-fifths of what they have paid for houses owned by themselves. In short, the central Government, the local authority, and the house owner contribute to the work in the proportions of 4 : 3 : 3 respectively.

That these provisions are practicable is shown by the success of the existing smokeless zones, and of housing estates where the use of smokeless fuels is a condition of tenancy (as in Bradford and Nottingham). The rate at which smoke control areas can be set up is at present uncertain. We do not know how many local authorities will wish to establish them, nor how soon. If the demand, so to speak, is small and slow, the supply and distribution of smokeless fuels, including gas and electricity, but more particularly the solid fuels, may keep up with it. On the other hand, if there is a rush for smoke control areas, some of them may have to await approval until the fuel supply situation is such that their needs can be fully met. It would not be helpful, and the Government no doubt has this clearly in mind, to give approval for smoke control areas if there may be difficulties that could cause dissatisfaction, or make the suspension of the scheme necessary because smokeless fuel was not available. The whole process must be developed with care and foresight. It is definitely a case where more haste may mean, in the long run, less speed.

* More accurately, what they have been *bound* to pay out. If the local authority pays out more than the seven-tenths the Government's contribution is *not* thereby increased.

Planning Smoke Control Areas

The preliminary planning of a smoke control area is important if it is to be brought into being smoothly and successfully and with the support of those who will be affected by it. A few matters of importance may be stressed.

1. The proposed area should be carefully studied and its boundaries considered, keeping in mind the subsequent extensions that are implied in the general principle.

2. The pattern of fuel usage in the area and all specific problems should be surveyed and examined. There will be the question of the conversion of domestic appliances; conversions or adaptations of central heating plant in "commercial" premises; the question of industrial premises, where each case may have to be decided on its merits. House to house calls, and in the case of larger premises, full discussions, are likely to be called for.

3. The fuel and equipment requirements must be estimated, the cost of

the domestic conversions determined, and the question of supplies discussed with the gas and electricity boards and the solid fuel distributors. The setting up of a special consultative committee might be useful to deal with these and other practical problems.

4. It is necessary that the fullest local publicity should be given to the project and discussion invited. This aspect is so important that it may be enlarged upon in more detail.

"Putting It Over"

It must be remembered that although the majority of people today are likely to approve action for clean air in general, there may be resentment or resistance to the particular action that will affect them directly and perhaps call for a sudden break in the habits of a lifetime. At first, in any town, only a minority are likely to be affected, and it is important to avoid any growth of a "why pick on us" attitude, by fostering the understanding that other areas will follow and that it is something of a privilege to be included in a smokeless area. It is therefore necessary to organize a careful and continuous campaign of education and propaganda. Part of this should be general clean air propaganda not specifically related to smoke control area schemes, but devoted to the indictment of pollution and the benefits of clean air; the second part should be concerned with the immediate practical problems that will arise in the area. It is hardly necessary, too, to point out that the scheme should be shown to be an important, even though small, beginning of a great and beneficial change in our way of life.

Concurrently with the creation of interest and understanding there must be the practical guidance and assistance to those who will be using new kinds of fuel and new kinds of equipment. Direct personal contact and demonstration may be called for and should be freely offered, either by the local authority or by the fuel and power distributors.

Finally, it is suggested that it should always be arranged that the coming into force of a smoke control order should be during the summer months, so that any initial difficulties may be minimized and the organization of the supply of solid smokeless fuel facilitated by being made outside the heating season.

In conclusion, the smoke control area section of the Clean Air Act will give this country the opportunity of making a unique social experiment which can be begun—in fact has already begun—but which will not be concluded for many years to come. It is an experiment based on careful thought and its practicability has already been proven by experience. The rate of progress will depend in part on technical and economic factors, and in part on the interest and co-operation of the public. In particular, in these early stages, it needs the help and understanding of all those in responsible positions who are able to influence and assist those who are less well-informed.

Miners Lose Cheap Coal

As a result of the Motherwell and Wishaw Town Council's decision to make the Coltness housing scheme of Wishaw a smokeless zone, some miners who live there will not now receive their cheap issue of coal. The miners, who receive about nine tons of coal a year at 22s.-24s. a ton, have complained to the National Union of Mineworkers and to the Town Council.

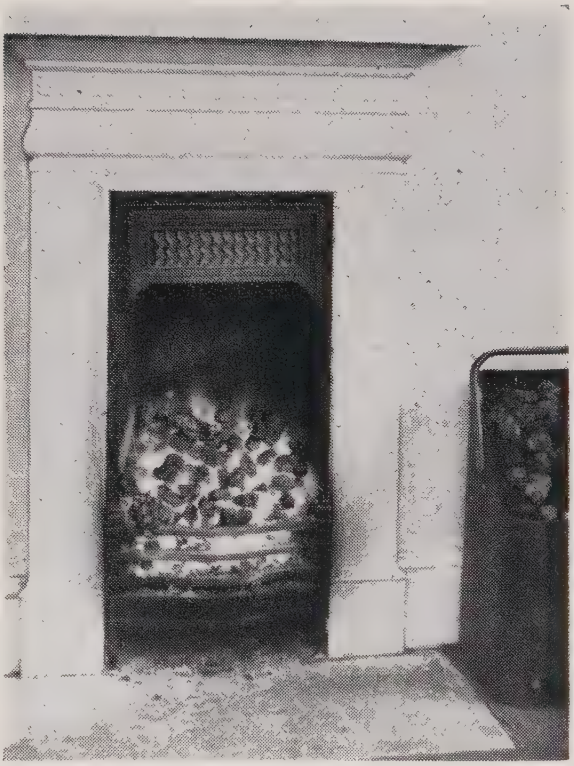
Southport's Ambition

The Health Committee of Southport aims at making it the cleanest seaside resort in the country. This follows a report from the Town Clerk on the Clean Air Act of 1956. "By voluntary co-operation it is hoped that this borough will become the cleanest seaside resort in the country," says a statement from the Health Committee.

THE NEW SOLID SMOKELESS FUELS

The gas industry is now producing two new types of high-quality solid smokeless fuel. The North-West Board, as announced by its Chairman, Mr. D. P. Welman in his paper at the Society's Southport conference, is now marketing a free-burning fuel that has been named "Thermalite." Another long-burning high-density fuel, named "Thermax," suitable for closed stoves, boilers, etc., is also under test but is not to be put on the market immediately.

Comparable with "Thermalite" is "Cleanglow," a free-burning fuel introduced by the North Thames Gas Board. Both of these fuels are easily ignited, burn clearly and freely on any type of open fire, and quickly recover on re-stoking. In both cases the fuels are produced from coals not normally considered suitable for gasworks processing, and the carbonization process is modified so as to produce the more active type of coke required. The North Thames Board is using a low rank Midlands coal—normally used raw on the domestic market—and is carbonizing it in continuous vertical retorts at the Ascot and Lea Bridge works. Both of these works have been turned over entirely to its production, and a yearly output of 75,000 tons is envisaged.



"Cleanglow" will burn brightly, even in a grate like this

In short, the gas industry is developing methods for the utilization of the domestic coal that will be displaced as progress is made under the Clean Air Act, and for turning it into first-class smokeless fuel. There will no doubt be difficulties and problems to be solved as this development progresses, as we hope it will, but North Thames and North-West seem to have made a good beginning in showing what can be done with new techniques.

One point comes to mind: if in due course all the Boards produce new types of smokeless fuel, will they all have different brand names? If so things might become a little confusing, and the advantages of one common name seem to be at least worth considering.

The Department of Civil Engineering, University of Durham, had published a lecture on **The Clean Air Act**, by Peter C. G. Isaac, Senior Lecturer in Public Health Engineering (Bulletin No. 8, 5s.). Mr. Isaac, who is a member of the N.S.A.S. Executive Council, first puts the Act in historical perspective, then discusses the Beaver Report, the novel features of the Act, and goes on to outline and discuss its general provisions. Finally he gives an excellent series of extracts from a number of American A.P. ordinances. This is a helpful and well-written contribution to the literature.

Smokeless Zones and Control Areas News

Scotland's First Smokeless Zone

The Secretary of State for Scotland has confirmed the " Edinburgh Smokeless Zone Order (No. 1), 1955 " which will come into operation on 1st March 1957. The Order prohibits the emission of smoke in an area of 250 acres known as the Sighthill Industrial Estate, wherein engineering, concrete, building and other contractors are in process of establishing businesses. A site in the centre of the City was considered as an alternative to the Sighthill scheme, but the latter was chosen on the one hand, because of the railway and old houses in the centre, and on the other hand because of the situation and scope for development of the Sighthill Zone. It is situated to the west of the City, thus taking into account the prevailing west—south-west winds. It is capable of being extended by the incorporation of two adjacent estates containing a total of 3,000 houses of modern construction, with easily converted modern grates, and better facilities for the storage of smokeless fuel. In general it was felt that the Sighthill Scheme bestowed the greatest possible benefit at least possible cost.

Other Smokeless Zones

Birmingham is preparing plans for two more smokeless zone, in addition to the two she already has. Of the new zones, one is an extension to the present city centre zone, and will cover an additional 61 acres. The other has an area of 56 acres and covers the site of a new housing estate on the northern boundary of the City.

Manchester is also extending its zones. The Minister of Housing and Local Government has confirmed orders setting up an 11-acres zone at Royle Green and another of 3 acres in the Bordley Walk area of Baguley. At Royle Green 193 houses and flats are being built and 59 at Baguley. All will be fitted with coke burning grates and gas pokers.

Salford has plans to bring into force a smoke control area under the new Act which will cover 130 acres. It will link together the City's two existing smokeless zones on the Ladywell and Fairhope Estates, by taking in Weaste and Wardleworth Estates and part of Pendleton. It will include 1,100 houses—700 Corporation-owned and 400 privately—Hope Hospital, St. James' (Hope) Church and Parish Hall, three schools, a motor-breaking yard, a lubricant works and several lock-up shops.

Lastly, returning to Scotland, Paisley has taken steps to make areas of the burgh smokeless zones. In particular, Foxbar and George Street-Canal Street are to be so designated.

Stockport Campaign

Propaganda and publicity are to be the first two steps in a long, and, it is hoped, far-reaching programme to be carried out by Stockport Consultative Advisory Committee for Smoke Abatement, which held its first meeting on 30th October at the Town Hall. Councillor C. J. Doherty, Chairman of the Health Committee, was elected Chairman. Lt.-Col. J. A. Christie-Miller, O.B.E., T.D., J.P., who represented Stockport Chamber of Commerce, was elected Vice-Chairman, and the Town Clerk, Mr. J. H. W. Glen, was elected Secretary.

To Reduce Smog

To reduce smog over London representation is being made by the metropolitan boroughs to the Treasury and Minister of Fuel to reconsider their decision not to exempt electrical heating appliances from hire purchase restrictions. The boroughs also request that new restrictions on capital expenditure by electricity boards for the sale of heating appliances, under hire purchase arrangements, should be removed.

Domestic Fuel Usage in Europe

From the United Nations Economic Commission for Europe comes **Trends in Fuel Consumption for Household and Domestic Use in Europe** (1956, 3s. 6d., or $0·50 U.S.). The student of domestic heating will find this report to be full of valuable information and data, especially in the comparisons that may be made between other European countries and the U.K. For example, the energy consumption per dwelling, divided by the number of degree-days* for the year 1952 is shown to be as follows (in coal equivalent, as kgs.):

United Kingdom ..	2·29
Western Germany ..	1·36
Sweden	0·81
Belgium	1·31
France	1·38

The factors accounting for these national differences is discussed. " Humidity, dwelling habits and poor insulation of buildings doubtless have a certain influence, but the main cause must be sought in methods of heating and fuel efficiency." The low figure for Sweden is considered to be such because the standards of insulation are more advanced than further south, and it is also shown that the proportion of centrally heated dwellings varies from 50 per cent. in Sweden and 35 per cent. in Denmark down to only 1 per cent. in the U.K. An interesting development in Sweden is a rapid rise in the use of gas for firing central heating boilers.

The report points out that perhaps " the main reason for the predominance of the open fire in the United Kingdom is that of tradition, the open fire being looked upon as an essential contribution to the feeling of comfort, whereas in other countries it is regarded as a social luxury and never as a main source of heating."

There are many other comparisons of interest, and much information on the uses and trends of different types of fuel, heating systems and power in Europe. Part II, dealing with the promotion of the efficient use of fuel is particularly important.

Railway Smoke Prosecution

A shortage of skilled steam-raisers was the explanation put forward on behalf of the British Transport Commission when they were summoned in September last by St. Pancras Borough Council for an alleged smoke nuisance. They pleaded guilty to a summons alleging that a locomotive steam-engine, using coal or other similar fuel emitting smoke, " and constructed on the principle of consuming and so as to consume its own smoke," failed to consume its own smoke.

Mr. Michael Mann, counsel for St. Pancras Borough Council, said that at 2.30 p.m. on 28th November, 1955, two Borough Council sanitary inspectors went to King's Cross Motive Power Depot and met a British Transport Commission foreman. " The three of them went to watch the locomotives," said counsel. " One of the engines which they saw was emitting a large quantity of dense smoke." They went to the engine and the foreman told the driver to close the damper. The driver said he could not because there was something wrong with the mechanism and demonstrated by pulling a lever. The two sanitary inspectors were present for about half an hour.

" The other gentleman was pushing the damper in and pulling the damper out ? " inquired the magistrate (Mr. Seymour Collins). " I think he gave up after a short time," replied Mr. Mann, who said that throughout the half-an-hour the engine was emitting dense smoke.

Mr. A. R. A. Beldam, counsel for the Commission, said that there was

* A degree-day is a measure of heating requirement. For any one day there are as many degree-days as there are degrees difference between 15°C (59°F) and the mean outside temperature. The total of degree-days for all days during the heating season thus expresses the annual heat demand.

no defect in the damper which would cause any excess emission of smoke. The trouble at this depot was that there was a shortage of steam raisers and an inexperienced person had coaled this particular fire. "Unless the fire has been coaled properly, smoke will be emitted," he said. "Too much coal had been put on the fire." The finding of skilled labour these days was extremely difficult. This was the first summons for this particular region and the Commission had the problem of smoke abatement well in mind.

The magistrate granted the Commission an absolute discharge on payment of five guineas costs.

Fruit Crops Fail

According to an article in *The Grower* of 22nd September, 1956, the fruit farm of two brothers in Bedfordshire is being badly affected by fumes from nearby brickworks. The article says that three or four times a year, when the north wind blows over the Hobbs' fruit farm at Woburn, it brings choking fumes and leaves dying foliage on the trees and bushes. When the weather is damp the effects are worse, and this year it was expected that the brothers would hardly take a crop. Worcester, Cox and Laxton apples were a complete failure. Blackcurrants and gooseberries were brown and shrivelled.

The brothers say the fumes contain sulphur and fluorine compounds and come from brickworks. Since the end of the war, many new brickwork chimneys have been built in the area, and now there are forty-five within about two miles. Twenty-six are only 1,000 yards away.

After the fumes have passed, the leaves of apple and plum trees drop off "just as though a bonfire had been lit under them," said Mr. Edmund Hobbs. The fruit stays on, but it does not grow properly and is unsaleable. A plot of Climax strawberries lost its leaves three times.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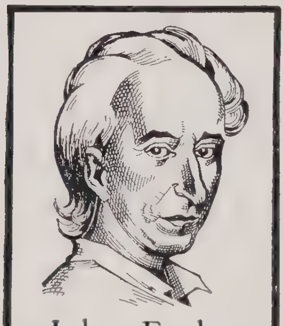
SMOKELESS AIR

THE SMOKE ABATEMENT JOURNAL

No. 101 SPRING 1957

ONE SHILLING

In this Issue



John Evelyn

Where there

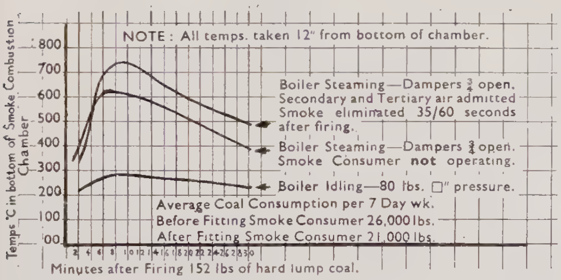
THERE NEED NOT BE SMOKE

is fire

The Godber Smoke Burner solves the smoke problem with all hand fired Lancashire Boilers or horizontally fired furnaces. It is quickly installed and operates automatically with chimney draught. The initial cost of installing a Godber Smoke Burner is recovered in six months by more efficient burning and the subsequent fuel saving.

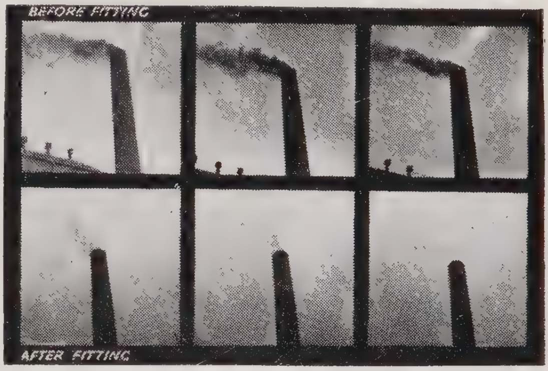
THE PRINCIPLE.Smoke is burned by impingeing 24 jets of warm air into a combustion chamber behind the bridge wall. This includes a baffle designed to give maximum turbulence and minimum stratification and so ensures complete combustion of unburnt gases and soot with maximum transference of heat evolved. Smoke Burners already installed have proved fully effective over a long period. Apart from limiting atmospheric pollution they improve thermal efficiency by lowering fuel consumption by an average of 10%. Side by side firing is quite unnecessary and the smoke burner takes in its stride all grades of fuel from slack to large nuts.

Reproduced below by kind permission of the London and Scandinavian Metal Co. Ltd. of Rotherham is a graph showing extra heat evolved in their 30′ x 8′ Lancashire Boiler. This is of course, secondary to the main purpose of the Godber Smoke Burner—effective smoke control.



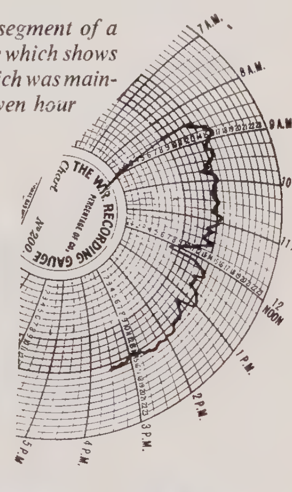
The Godber Smoke Burner can be fitted to a 2 flue furnace in approximately 10 hours. As the Godber Smoke Burner is contained within the flue of the boiler no modifications to the shell are required. British Patent No. 743650.

Full technical information and advice is available to interested firms. The effectiveness of the Godber Smoke Burner can also be demonstrated by arrangement at existing installations.



How effectively smoke is controlled is indicated by the unretouched photographs shown here. The 'before and after' shots relate to a hand fired natural draught Lancashire Boiler. The damper settings were identical. One cwt. of large nuts was fired to each grate and the photographs taken at the instant when fire doors were closed and at 15 second intervals. Conclusive evidence of the efficiency of the Godber Smoke Burner.

Reproduced here is a segment of a C.O.2. recording gauge which shows approximately 14% which was maintained throughout a seven hour test on a hand fired Lancashire Boiler.



To prove conclusively that the Godber Smoke Burner does all that we maintain we are prepared for a limited period to install on a one months approval basis.

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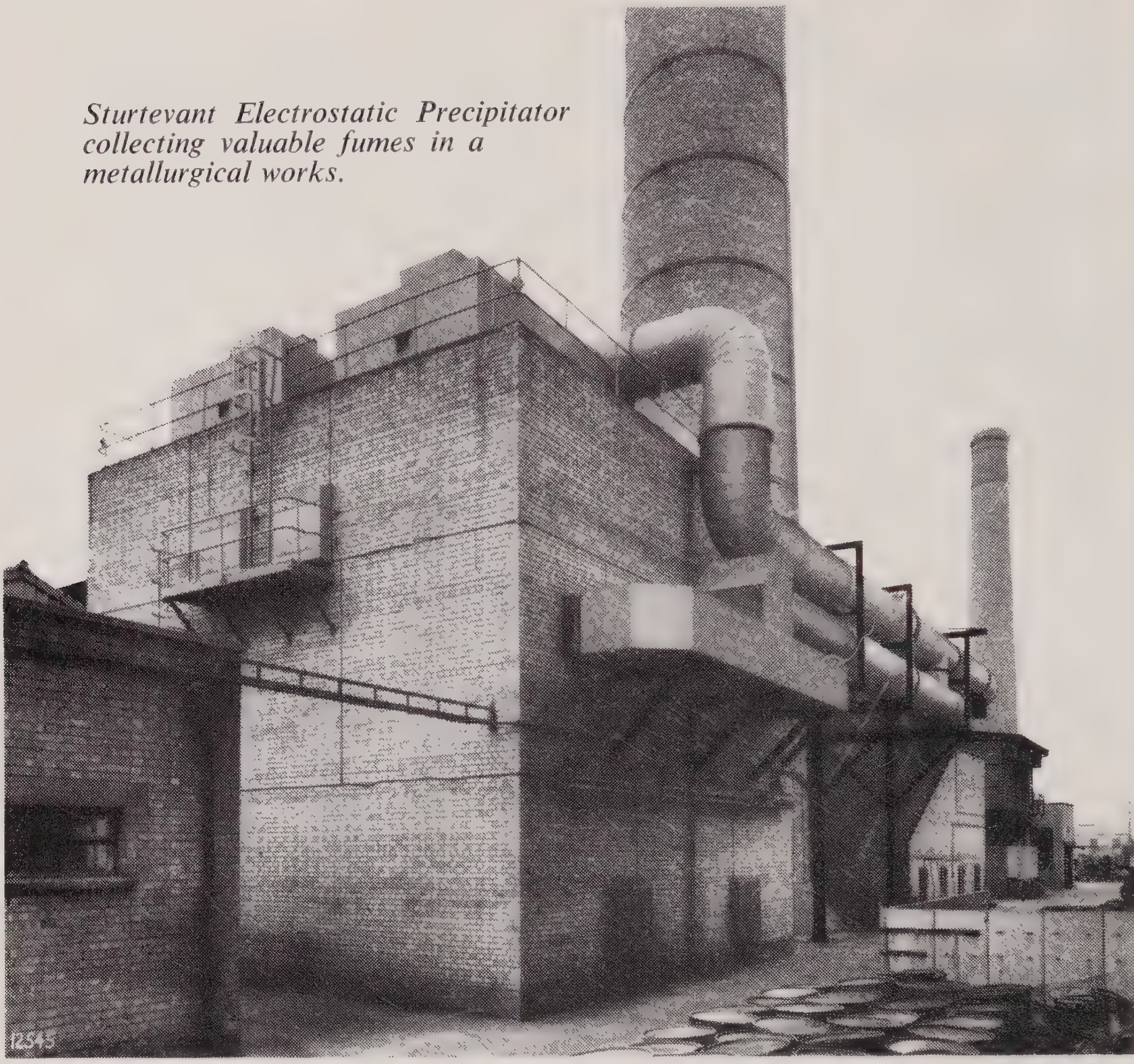
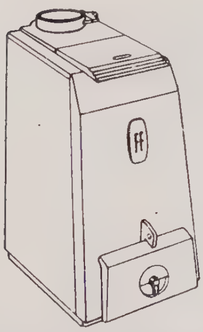


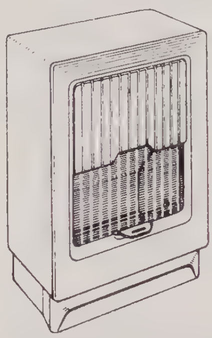
SMOG

the menace to health and wealth

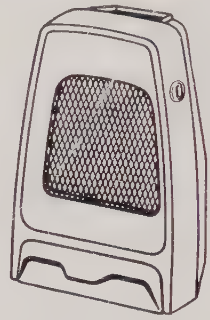
The days of "smog" are numbered. Many smokeless zones are now scheduled and will soon be in operation. Thousands of appliances for burning smokeless fuels will be needed. Our units, a few of which are illustrated below, are the results of many years' experience in the design and manufacture of smokeless fuel burning fires, stoves and cookers. Full details of appliances on request.



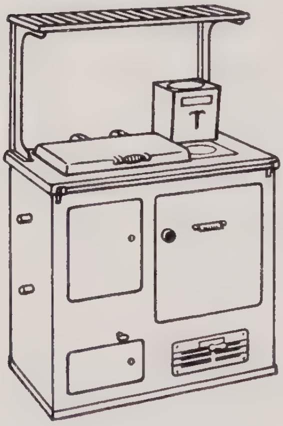
SOFONO STOVE No. 1 & 2



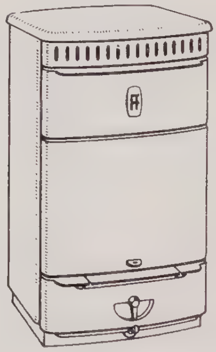
SOFONO SUNRAY HOMEHEATER



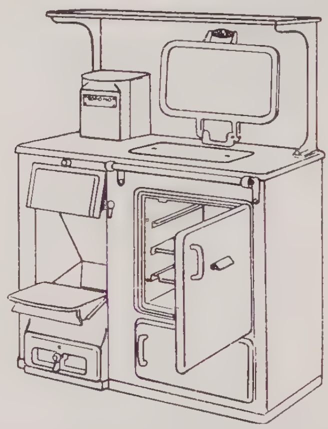
SWIFT FIRE



SERVITOR COOKER



SOFONO STOVE No. 3, 4 & 5



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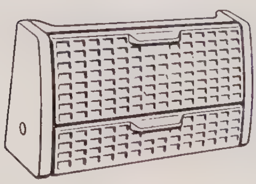
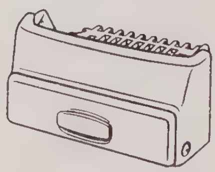
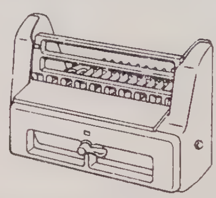


SOFONO FULL-VIEW FIRE



SOFONO LO-FRONT FIRE



SOFONO DROP FRONT FIRE

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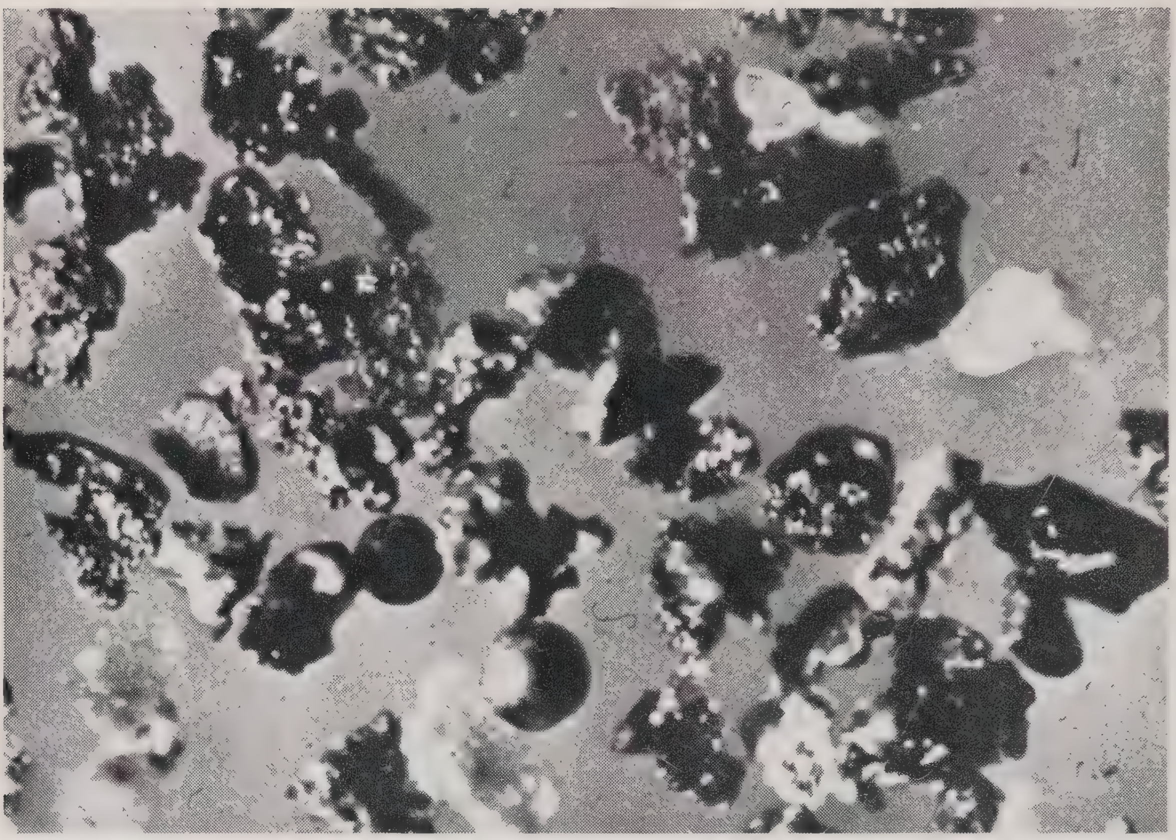
A FEDERATED FOUNDRIES COMPANY



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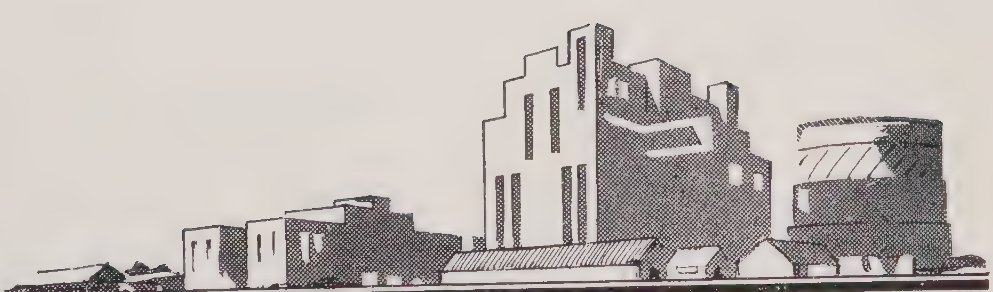

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SMOKELESS AIR

Vol XXVII. No. 101 Spring 1957

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SMOKELESS AIR is published quarterly by the National Smoke Abatement Society at Palace Chambers, Bridge St., London, S.W.1. Tel: TRAfalgar 6838-9 (Editorial and Advertising). Issued gratis to Members and Representatives of Members. Subscriptions rate for SMOKELESS AIR only, 4s. per annum, post-free.

Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

Comment

The Act in Force

THE Government is to be commended on having succeeded in bringing certain sections of the Clean Air Act into operation before the end of 1956. Elsewhere we describe in some detail the parts of the Act that are now operative, together with accounts of the explanatory memoranda that have been issued by the Ministry. More unexpectedly the Minister has also issued, under section 24 of the Act, a model building byelaw which requires that arrangements for heating and cooking in new buildings shall prevent as far as practicable the emission of smoke. The byelaw, which we quote in full, is simple and straightforward, and we are both gratified and intrigued to see it. It will perhaps be remembered by only a few of our present members that the Society took part in the discussions (led by the London County Council) to secure byelaws precisely of this kind when provision for them was made, as in the Clean Air Act, in the Public Health (Smoke Abatement) Act, 1926. The Ministry then responsible refused either to approve byelaws proposed to it by local authorities or to issue its own model. Apparently it could not be done, with the result that we have had to wait thirty years for that part of the 1926 Act to be implemented! What a welcome difference a change of heart can make in Whitehall as elsewhere. Now, indeed, a note on the byelaw states that the Minister will *welcome* its adoption by local authorities in urban areas. Local authorities, *please* note!

The Memoranda

The two memoranda that have been issued are generally regarded as good, workmanlike documents, but there have been one or two criticisms. A local authority comment on the smoke control areas memorandum is that it tends to make everything seem rather too complicated and difficult, and might therefore inhibit the more timorous authorities from action. Elsewhere in this issue there is a penetrating examination of the consequences of the insistence that grant-aided conversions shall be to the cheaper, and therefore less efficient, types of appliance.

The notes for the guidance of local authorities in giving approval for new furnaces under Section 3 of the Act, which are given at the end of the Miscellaneous Provisions memorandum, have also come in for some criticism, and are in fact being examined by the Society's Technical Committee. It is interesting to note, therefore, that they appear to be very largely based on the prior approval code drawn up and used by the Corporation of Manchester in connection with its own Acts of 1946 and 1950. In some cases the wording is identical, but the Manchester code (which was published in full in *Smokeless Air*, No. 70, Summer, 1949) goes into rather more detail and on the whole appears to be preferable to the official suggestions simply because of this. We understand that the Manchester code has worked quite satisfactorily and that no reason has been found for wanting to amend it.

Both codes state that the designed output or evaporative capacity of a boiler should be not less than 20 per cent. above the known maximum load. For boilers using bituminous coal Manchester states specifically that they shall be fired mechanically. The Ministry's advice is that " in suitable cases furnaces should be mechanically fired, or if this is impracticable they should be fitted with smoke eliminating doors of the F.R.S. type."

Section 25 and the Society

Among the provisions of the Act now in force is Section 25, which empowers local authorities to spend money on publicity, education, research and investigations. The need for the education of the public, which has always been the Society's aim, was emphasized by the Beaver Committee and is reaffirmed in the Ministry's own memorandum on smoke control areas, which quite plainly says: " Above all, progress—and indeed the whole success of the operation—will depend upon public support; upon people's understanding of the problems involved, and their readiness to co-operate in smoke control measures."

The activities of the Society, and the services it is providing for its local authority members (and others) are all directed to these ends, and if Section 25 is examined in detail it will be seen that with two exceptions there is nothing mentioned that is not already being done or provided by the Society. Reference is made in the section to investigations, research, the publication of information, lectures, addresses and discussions, the display of pictures, films and models, and the holding of exhibitions. It also empowers local authorities to make contributions to the cost of preparing such material. The only things in the list that the Society does not at present provide in one form or another are research and films. (Even here we take research to mean experimental work; library research is often undertaken. And it is only lack of funds that has so far prevented the production of our own films).

As our members are well aware, although we are doing these things we are able to do only a fraction of what is necessary. And the pressure for publications, exhibits and other display material is steadily increasing. To do this work satisfactorily is possible only if our annual income can be increased at least five-fold. At present, although our services are very largely to local authorities they are contributing only one-third of our present inadequate funds. *Verb. sap.!*

Sustaining Members

Apropos the preceding paragraph, one of the interesting points about the Society's proposed new constitution—discussed on another page—is for the designation " Sustaining Member." This is simply a way of giving deserved recognition to those who subscribe substantially above the minimum—£100 a year is suggested—and so do materially " sustain " the Society. So far only some industrial bodies are Sustaining Members, but we are hoping that some of the larger local authorities and perhaps even individuals may be added to the list. It would need only 200 such members to give the Society the chance it needs.

Dr. Parker

All readers who know him, and they are many, will join with us in extending our best wishes to Dr. Albert Parker, C.B.E., on the occasion of his retirement as Director of Fuel Research in the D.S.I.R. Dr. Parker, who had occupied this post since 1943, was keenly interested in the problem of air pollution, and under his guidance much valuable work on this has been done at the Fuel Research Station. He has given papers to the Society on more than one occasion, including the Des Vœux Memorial Lecture in 1955. Dr. A. C. Monkhouse, formerly Deputy Director, has been appointed Acting Director, and to him also we extend our good wishes.

Industry and the Act

In noting the action being taken by different local authorities to make known the meaning of the Act to industry, we would like to comment for consideration by others what has been done in two cases, Salford and Croydon. At Salford the corporation convened a conference, opened by the Mayor, at which were present nearly a hundred representatives from leading industrial firms in the city, together with a panel of corporation officials and delegates from the national fuel and power industries. The provisions of the Act were described by the corporation's senior solicitor, and from the press report there was a considerable amount of useful, practical discussion. An industrial representative, proposing a vote of thanks to the city councillors and the panel, at the end of the meeting, paid a tribute to them when he said: " It is nice to think that you can go to the local authority with any difficulty regarding the clean air campaign. They are very human and just the right people to approach."

Croydon's enterprise has taken the form of sending a letter direct to every appropriate industrial and commercial concern in the borough, and enclosing with it a copy of the Society's *Summary of the Clean Air Act*. For this purpose 1,000 copies have been purchased. The *Summary* is continuing to sell very briskly, and the next edition will be revised so as to show what parts of the Act are now in force.

Unauthorized Wood

In a not entirely serious note on the Clean Air Act the *Law Journal* laments the omission of wood from the list of authorized fuels in smoke control areas: " It is sad to think that in areas made the subject of smoke control orders the burning of a log in the domestic grate may be penalized to the extent of a £10 fine." However, with its experienced eye for legal niceties the Journal sees a way out. " Enthusiasts for log burning," it is pointed out, " should not be misled by the Explanatory Note on the Regulations, for an offence is committed only if the smoke is emitted from the chimney of a building. By judicious use of one of those modern devices that control the chimney throat, and by opening the French windows, it will be possible to enjoy a wood fire in much the same way as our earlier forefathers did."

Bristol's Bouquet

That Australia may be needing a clean air drive seems to be indicated by two of its citizens, two young ladies, who have been touring this country and who, it is reported, have been going into raptures about Bristol, particularly " its clean fresh air." Such a handsome tribute to any British city is so unusual and so unexpected that it is understandable that the *Bristol Evening Post* should proudly publish it. We hope, however, that it does not lead to Bristol relaxing its efforts for even cleaner air. After all, who knows, there may still be some lurking vestiges of pollution not noticed by the Australian girls. . . .

As Others See Us

The members of a Society see it from the inside, and it is always useful—sometimes gratifying, sometimes salutary—to know what impression it gives to those outside its ranks. *Town and Country Planning*, the monthly journal of the T. and C.P. Association, in a recent editorial note, is exceptionally kind:

" The coming into force of the Clean Air Act on January 1st is a suitable occasion to pay tribute to another brilliantly run and effective voluntary body—the Smoke Abatement Society. It has maintained for many years a most determined and practical campaign for its objective, and we are very glad to see that its efforts, which have already produced a number of experimental smokeless zones, have now led to national legislation."

The Society's Proposed New Constitution

Plans for Incorporation

THE Society considerably revised its original constitution in 1946, and during the last year the Executive Council and a special sub-committee (which has included a representative from each Division) have been studying further revisions that experience and growth have shown to be desirable. This work latterly came to include consideration of the value of the Society seeking incorporation—that is, that it should be registered as a company, limited by guarantee but without share capital. Many other organizations of a similar kind are of course incorporated in this way.

That the new constitution should include proposals for incorporation was endorsed, without dissent, by the Annual General Meeting of members held in Southport on 5th October last. It was also agreed that the proposals should include a change of name to National Clean Air Society, and that a special general meeting be held as soon as possible to consider the proposed changes.

From the draft that is being sent to all members (and representatives of members) it will be seen that because of the requirements of the Companies' Act and of the Board of Trade, the constitution is considerably expanded. The material falls into three parts—the Memorandum of Association, the Articles of Association and the Byelaws. Everything in the Memorandum and Articles is legally necessary and cannot be omitted. Much, in fact, is in standard or recommended form and even amendment of wording is not advisable. Rules which are not required in the Memorandum or Articles are included in the Byelaws, which are not subject to external approval and may be altered at any time by the members of the Society.

Why Incorporation?

At present the Society is unincorporated and as such it is without legal status. In the eyes of the law it has no legal personality or life. This may not be of importance to an organization that is small and has little to gain or lose, but as it grows the disadvantages become more apparent and might be serious. Thus at present the Society cannot own property, make contracts, sue or be sued. In the event of a breach of trust over any agreement redress in the courts could only be sought through a " representative action." On this point the law is obscure and such actions are often impossible. What property the Society does possess has hitherto been held through trustees or nominees—a responsibility that tends to become more onerous and less satisfactory as the activities and size of the Society continues to increase.

What is more, and this is of concern to every member, any creditor of the Society could claim (if the Society became penniless or its organization broke down), to the full extent of the amount owing to him, against the property of *any* member. This is not, of course, likely to occur, but it is a legal possibility that is clearly undesirable.

These disadvantages are overcome by incorporation, from which a number of further advantages follow. As a company limited by guarantee the Society could have a legal existence of its own, and could own property, enter into contracts and leases in its own name, and sue or be sued. Its contracts—with staff or

other persons or organizations—would be legally enforceable.

The liability of members for possible debts of the Society in the event of it being wound up would be limited to a specified amount. In the draft Memorandum of Association the amount that is proposed is only five shillings—a sum which is only a small fraction of the subscription paid annually to maintain membership.

The fact that an association is incorporated increases confidence in it by making it more apparent that it is organized and conducted in a responsible manner. For a body like the Society, which is seeking to increase its membership and income this is an important further argument in favour of incorporation.

The Other Changes

The parts of the new constitution that have been taken from the existing one have been included in the Memorandum, the Articles or the Byelaws according to their purpose. There are quite a number of minor changes of phrasing, for clarification or better definition, but the number of important changes is quite small. These may be noted as follows.

Name.—The fact that there was no dissent to the Southport resolution that the name should be changed, indicates that the need for change is now generally agreed. The use of the positive term " Clean Air " in the new Act is hastening the demise of " smoke abatement," which has now acquired a rather restricted, rather timid, and definitely an old-fashioned flavour. (We find that there are still people who think that the Society is not interested in the problems of dust, grit, sulphur dioxide, fumes from vehicles, and the like!).

Honorary Members.—The new constitution provides for the election of what would be more accurately described as " Members of Honour." These will take the place of the Vice-Presidents, except that the existing Vice-Presidents will remain in being. Under the present constitution any member could be nominated as a Vice-President by any other member, and although the Executive Council had to approve such nominations, to reject them could obviously be a matter of some embarrassment. Moreover, Vice-Presidents, elected to an office intended to be a mark of esteem for service rendered to the cause, had to be re-nominated each year, always with the possibility of a ballot being required if the number of nominations exceeded 20. What is now proposed is that there should be a small Nominations Committee, consisting of the President, Past-Presidents, Chairman and Deputy Chairmen of the Executive Council, which after considering what advice it may seek or be given, should make nominations for Honorary Members to the Executive Council, which in turn would report the nominations to an Annual General Meeting for approval. Once a person has been honoured in this way he would remain an Honorary Member for life or until he resigned. The Executive feel that this procedure will be more dignified and will avoid any of the difficulties that may arise under the present arrangements.

In addition, provision is made for not more than three Senior Vice-Presidents, who are intended to be what the term implies—officers to act in place of the President and as his lieutenants and possible successors.

Sustaining Members.—This new designation has been included to provide a means for showing appreciation to those members whose subscriptions generously exceed the required minimum for membership and who do, in fact, largely " sustain " the Society. It will apply to any class of member—individual, local authority or corporate—whose annual subscription is £100 or more. Other bodies have found this to be helpful in encouraging larger contributions and in our own field it has greatly assisted our opposite number in the U.S.A., the Air Pollution Control Association, to augment its income and become a more effective body. It should be noted that Sustaining Members do not receive any special privileges—only

the expression of thanks that will attach itself to being listed under the designation.

Branches.—The new constitution provides for Divisions of the Society in the same way as at present, and for the setting-up of Divisional Councils. It now goes further in providing for Branches to be established, where desired, in any town or district within a Division. A Branch would be under the wing, so to speak, of the Divisional Council, which would make a grant to cover its expenses. As with the Divisions, Branches would consist only of members of the Society and of representatives or delegates of members, and their subscriptions would continue to be paid to the national body.

Delegates.—Local Authority and Corporate members appoint *representatives* to act on their behalf, including participation in the activities of the Division in which the member is situated. A number of Corporate members, however, have their headquarters in one Division but branches or sections in other Divisions. At present the representatives are attached to the Division in which the member is registered, but there is no contact (except possibly by " co-option ") between their branches or sections with the other Divisions of the Society, despite the fact that often there are persons who would be interested in Divisional activities and could be of service. It is therefore proposed that to overcome this difficulty a Corporate Member (the point does not of course affect Local Authorities) in addition to its representatives in its " home " Division, may appoint one or two *Delegates* to each Division in which it has branches or sections. Unlike the representatives, such Delegates would not exercise national voting or other rights of members.

Among the many additions to the constitution that are required by law, will be noted provision for the appointment of proxies to attend and vote at general meetings, more detailed regulations for procedure at general meetings, for accounts and audit, and so on. At first sight it may seem to be bringing overmuch bureaucracy into a Society that, unlike many, does not exist for its own sake but simply for the pursuit of its declared objects. Nearly everything that will be required is, however, already being done, and it is not anticipated that the Society will have to pay so much attention to its organization that its object will cease to be in the forefront. Rather does it give the Society a firmer base from which its activities can be directed with greater vigour and ample flexibility.

Natural Gas in Scotland

As part of the Gas Council's five-year programme of exploration for supplies of natural gas in Britain, the Scottish Gas Board propose to carry out a prolonged test of the natural gas resources existing at Cousland, near Edinburgh, to establish whether the supplies of town gas to consumers could be augmented from this source on a commercial basis.

This will mean that, while the test is in operation, gas consumers in the Musselburgh and East Lothian areas of Scotland will be using in their homes and factories town gas consisting of a mixture of natural gas and coal gas.

The presence of natural gas at Cousland was proved by an exploration well drilled by the BP Exploration Company before the war, but the exact size of the reservoir is not established with accuracy. A well drilled by the Gas Council in 1954 showed that the field could only be of restricted extent.

By using the natural gas from the existing well it will be possible to observe pressure decline that will enable a better assessment to be made of the advisability of drilling another well in the neighbouring locality, to define more accurately the limits of the prospective formation.

THE CLEAN AIR ACT BEGINS TO OPERATE

The Position in Outline

A NUMBER of the provisions of the Clean Air Act came into force on 31st December, 1956, under the Clean Air Act, 1956 (Appointed Day) Order, 1956.

The sections now in operation are listed for ease of reference as follows, the figure given being the section number in each case.

3. *New furnaces to be as far as practicable smokeless.* Local authorities must be notified. Prior approval may be asked for.

4. *Density Meters.* The Minister may now make regulations requiring installation of smoke density indicators or recorders.

10. *Height of chimneys.* Local authorities may reject building plans if chimneys are not of reasonable height for the dispersion of gases.

11-15. *Smoke Control areas.* Local authorities may make Smoke Control Orders and follow the procedure laid down in the Act for the establishment of such areas.

17. *Special Cases.* For premises scheduled under the Alkali, etc. Works Act the provisions in the Clean Air Act that are now operative are the responsibility of the Alkali Inspectorate.

18. *Colliery Spoilbanks.* All practicable means must be used for the prevention of combustion and the emission of smoke from deposits from a coal or shale mine or quarry.

21. *Research Exemptions.* Local authorities may temporarily exempt from action under the Act premises where research relevant to the prevention of air pollution is being conducted.

22. *Crown Premises.* Local authorities to report cases to the responsible Minister of contravention by Crown premises of a smoke control area order.

23. *Clean Air Council.* The Council (and the Council for Scotland) may now be established.

24. *Building Byelaws.* Byelaws for smokeless heating and cooking in new buildings may be adopted. A model byelaw has been issued.

25. *Research and Publicity.* Local authorities may incur expenditure on research, education, publicity, etc.

26. *Disclosure of Information.* It is an offence to disclose improperly, information obtained in administering the Act.

27. *Penalties.* Penalties as specified, as far as they are at present applicable.

28 to 37. *Administrative and Legal.* These concluding sections of the Act also come into operation in so far as they are at present applicable.

The principal sections of the Act *not* yet in operation are those relating to dark smoke, dust and grit, smoke nuisances, railways and shipping. A circular the Ministry of Housing and Local Government (M.H.L.G.) issued with the Appointed Day Order and the other documents mentioned below states that the Minister intends, at a later date, to make an Order fixing a date in the early part of 1958 as the appointed day for the remaining provisions of the Act.

THE BUILDING BYELAW

Section 24 of the Act provides for building byelaws to "require the provision in the new buildings of such arrangements for heating and cooking as are calculated to prevent so far as practicable the emission of smoke." A similar provision was also included in the Public Health (Smoke Abatement) Act, 1926, and a Model Byelaw was issued by M.H.L.G. on 28th December, 1956. This may be quoted in full:

There shall be provided in a new building (except in so far as heating is provided by furnaces to which section 3 of the Clean Air Act, 1956, applies) only such appliances for heating or cooking as are suitably designed for burning any of the following fuels, namely:

(*a*) gas;

(*b*) electricity;

(*c*) gas coke, or anthracite,

or are appliances of a description exempted conditionally or unconditionally from the provisions of section 11 of the Clean Air Act, 1956 (which relates to smoke control areas) by any order for the time being in force under sub-section (4) of that section.

(2) This byelaw shall not apply in relation to a building begun before the date on which the byelaw comes in operation, or begun after that date in pursuance of plans deposited in accordance with byelaws before that date.

(3) Nothing in the foregoing provisions of these byelaws shall be taken to apply this byelaw when an alteration or extension is made to a building.

The reference to section 3 of the Act means that the byelaw does not apply to new buildings using heating apparatus with a maximum capacity of 55,000 or more B.Th.U's. per hour. Such larger apparatus is controlled by section 3 itself.

It will be seen from the terms of the byelaw that inherently smokeless appliances—for gas, electricity, coke or anthracite—are allowed without further definition. Appliances suitable for coke or anthracite will burn the low temperature carbonization and other smokeless fuels, and of course coal itself. Coal may still be used, except in smoke control areas, and the importance of the byelaw is that it will do away with the need for conversions in any area that may be declared a smoke control area in the future. Appliances suitable only for coal or for oil will have to be of an approved nature under section 11 of the Act, which itself is concerned with such appliances in smoke control areas. That is, if the Minister approves a coal or oil burning appliance for use in a smoke control area, it will also meet with approval under the model byelaw.

SMOKE CONTROL AREAS

M.H.L.G. have issued a 36-page Memorandum on Smoke Control Areas, a copy of which has been sent to all local authorities. The memorandum is an informative discussion of the many questions that will arise when the establishment of smoke control areas is being considered by local authorities. It gives authoritative guidance on matters of importance and detail, together with stage-by-stage advice on the work to be done and the procedure to be followed by an authority in setting up a smoke control area. It also includes appendices of a model order, a model notice for publication and specimen tables for additional requirements of smokeless fuels, estimated costs of adapting and replacing fireplaces, final costs and final " summary of expenses for calculation of Exchequer contribution."

One of the early paragraphs of the notes may be quoted in full (our *italics*, to indicate approval!):

> " *The establishment of smoke control areas will necessarily be gradual; it will need to be undertaken in stages, over a period of years in the larger towns. Progress will be governed by the supply of smokeless fuels, the rate at which appliances can be converted or replaced and the rate at which local authorities are able to formulate and carry through their smoke control plans. Above all, progress—and indeed the whole success of the operation—will depend upon public support; upon people's understanding of the problems involved, and their readiness to co-operate in smoke control measures.*"

An important section deals with the nature of adaptations eligible for grant, and gives the principles to be observed, with typical examples. Thus:

> "No additional facilities need be provided.
> *Example:* Where there is no existing hot water system, water heating appliances cannot be provided with the aid of grant."
> "Appliances seldom used need not be adapted or replaced.
> *Example:* Bedroom fires not in regular use."
> "Where it is reasonably practicable and cheaper, the adaptation rather than the replacement of an existing appliance is all that is necessary.
> *Example:* Altering the spacing of fire bars in a grate or providing gas ignition for an open fire otherwise capable of burning smokeless fuel."

Another principle of some importance is that "where replacement of an appliance is necessary, reasonable freedom of choice should be given to the owner or occupier as between solid fuel, gas, electric and oil-burning appliances provided that the total cost of the alternatives is broadly comparable."

The whole of this memorandum will need to be studied with care by local authority members and officers. One or two criticisms that have been made are discussed elsewhere.

THE AUTHORIZED FUELS REGULATIONS

Also issued and coming into force on 31st December, 1956, was the Smoke Control Areas (Authorized Fuels) Regulations, 1956. These relate to section 11 of the Act, which states that in any proceedings for smoke emission from a building in a smoke control area "it shall be a defence to prove that the emission of smoke was not caused by the use of any fuel other than an authorized fuel."

One is not *required* to burn an authorized fuel in a smoke control area, but if smoke is emitted the only defence is that it was in fact due to the burning of an authorized fuel as listed in the regulations. These fuels are as follows: anthracite, briquetted fuels carbonized in the process of manufacture (e.g., "Phurnacite"), coke (which will include the new fuels "Cleanglow" and "Phimax"), electricity, gas, low temperature carbonization fuels (e.g., "Coalite" and "Rexco"), and low volatile steam coals.

Smoke is not normally emitted from any of these fuels, but occasions could arise when any of the solid fuels emitted smoke because of faulty preparation or the accidental presence of bituminous coal. In such circumstances the defence provided is clearly fair and necessary.

The fuels that are authorized follow the lines previously laid down in some of the local Acts with smokeless zone provisions. As in those cases, oil is not included, for the simple reason that although it can and should be burned smokelessly, it can also, if used improperly, produce considerable smoke.

There is nothing in the Act or the regulations to prevent the use of bituminous coal in, say, an underfeed Stoker for a central heating plant. The onus is, however, on the user to ensure that it is burned smokelessly. There will be no defence if it is not.

One detail is that although it is generally known what is meant by "low volatile steam coals," there does not appear to be any legal definition of this class of coal. In classification by volatile content the steam coals move in one direction towards anthracite, which as an authorized fuel presents no difficulty. But with increasing volatiles they move towards the bituminous coals. Where exactly is the dividing line?

THE MISCELLANEOUS PROVISIONS MEMORANDUM

The remaining document issued by the Ministry on the Clean Air Act is the explanatory "Memorandum on Miscellaneous Provisions." This discusses only the provisions that are now in operation, other than the smoke

control areas. The information is both compact and useful in both a practical sense and from the administrative standpoint.

The memorandum discusses each section of the Act, and a few of the most important or most interesting notes may be quoted.

Discussing the voluntary prior approval provisions of section 3 (new furnaces to be as far as practicable smokeless) the memorandum says:

> " In some cases the nature of the installation may present difficult technical problems and the local authority may find it desirable to seek a second opinion on the plans and specifications submitted to them. They could, if they wish, approach the National Industrial Fuel Efficiency Service or employ the services of a consultant. Some local authorities with powers of prior approval under Local Acts have found it useful for this purpose to appoint advisory panels whose membership includes Consultants, leading local industrialists and a representative of N.I.F.E.S. This is a useful way of associating industrial firms with the work of the authority on clean air and may encourage other industrialists to submit plans for approval. Notes on the main considerations to be borne in mind when examining applications for approval of new furnaces are attached in Appendix I."

On the height of chimneys (section 10) the memorandum suggests that:

> " Local authorities will find guidance about the technical considerations governing the height of chimneys in the memorandum printed as Appendix VI to the Report of the Committee on Air Pollution (Cmd. 9322). They should also have regard to the definition of " practicable in section 34 of the Act. When considering plans involving tall chimneys the local authority should, where appropriate, consult the local planning authority."

The Alkali Act.—It is pointed out that section 17 of the Clean Air Act (special cases) comes into operation on the first appointed day, and from that day virtually all forms of air pollution from premises controlled under the Alkali Act will be the subject of control by the Alkali Inspectorate.

On the Building Byelaw previously referred to the memorandum states that:

> " The purpose of the byelaw is to ensure that domestic appliances installed in new buildings are capable of burning smokeless fuels or otherwise capable of smokeless operation. There will, of course, be no statutory obligation to use smokeless fuels (coke, anthracite, Coalite, etc.) until a smoke control area is created but the adoption of the byelaw would render adaptations of fireplaces unnecessary, should the building later be included in such an area."

And also:

> " The Minister would welcome the adoption of the model byelaw by local authorities in urban areas. Authorities are asked to submit the byelaw to the Department in draft before taking steps to adopt it formally."

Research and Publicity.—The memorandum explains the provisions of section 25, authorizing local authorities to undertake research and publicity activities with respect to the problems of air pollution without the previous restrictions imposed under the Public Health Act, 1936 and the Public Health (London) Act, 1936. A comment on these powers is made in our editorial pages.

Notes on Prior Approval.—The memorandum concludes with an appendix of " notes on applications for approval under section 3(2) to new furnaces." These are brief notes intended for the general guidance of local authorities, dealing with the size of boiler, combustion rates and space, fuels, draught, flues, dampers, feed water and instruments.

APPLIANCES IN SMOKE CONTROL AREAS

The Government's Policy Examined

By G. E. Foxwell, C.B.E., D.Sc.

Government Committees (e.g., the Simon Committee in 1946) have stated in their reports that domestic heating in Britain is grossly inefficient both in the use of fuel and the degree of comfort heating achieved. The Simon Committee declared that they were unable to find any other civilized country in the world in which domestic fuel is used with an inefficiency approaching ours, and in which the area warmed around the fire was so small. That this is still a valid criticism was shown by the papers and discussions at the Domestic Heating Conference of the Institute of Fuel in May 1956.

Improvement depends partly on better housing construction embodying lower heat losses, a matter with which this memorandum is not concerned, and largely on the provision of modern appliances. It would seem that if the new appliances put into existing houses are on much the same lines as the old appliances the position as regards fuel consumption (in terms of coal used to produce the fuel that is used to produce the heat) and ineffectiveness of heating will be much the same in the future as in the past. An opportunity will be lost that will not recur in our generation.

The major improvements that should be included in appliances for smoke control areas are:

(1) To reduce the amount of heat carried away by excess air drawn up the chimney; i.e. to confine the air-changes in the room to the degree required for proper ventilation. This will reduce fuel consumption and increase comfort. There is here indicated a need for proper restriction of the flue outlet—a principle embodied in good modern appliances.

(2) To improve the efficiency of heating and to provide adequate comfort conditions in all parts of the room and not merely in the small zone round the fire by installing appliances that will heat by convection and radiation instead of, as in the open fire, by radiation only. There are several forms of appliances that fulfil this condition.

The onus of providing appliances that will burn smokeless fuels is placed by the Act on the owners of property and the local authorities. The tendency of both would be to incur the minimum capital expenditure unless otherwise advised by the Government. It is submitted that the " Memorandum on Smoke Control Areas " issued by the Ministry of Housing and Local Government will have the effect of perpetuating the present unsatisfactory conditions.

It is submitted that the N.S.A.S. has a vital interest in this question because:

(1) The cost of burning smokeless fuel should be reduced by all practicable means to encourage wider use. The more efficient the appliances and the great comfort it gives, the less will be the resistance to using smokeless fuels and setting up smoke control areas.

(2) The less solid fuel is used, the less sulphur dioxide is emitted.

The Ministry's Memorandum

The particulars in which the Memorandum on Smoke Control Areas will perpetuate unsatisfactory domestic heating are these:

Paragraph 25 states that although

the Act does not define what works are " reasonably necessary " to permit smokeless fuel to be burned, the Ministry " will require local authorities to adhere to the principles stated in the next paragraph for determining what types of works and what standard of works are reasonably necessary."

Paragraph 26. It would be possible to criticize several of the principles embodied in this paragraph and referred to in paragraph 55 but the following are considered the most important:

No. 4 states:

" Where it is reasonably practicable and cheaper, the adaptation rather than the replacement of an existing appliance is all that is necessary. Example:

Altering the spacing of firebars in a grate. . . ."

The intention behind this is probably admirable, i.e. when a good modern appliance has been used on coal and has a grate with bars space $\frac{3}{8}$ in., all that is needed is to provide a grate space $\frac{5}{8}$ in. at the cost of a few shillings.

The objection is that many ordinary inset open fires, with unrestricted chimney throats, can—either in fact or in the opinion of one of the authorities mentioned in paragraph 12 of the Memorandum—be regarded as capable of complying with the Act if a new grate is provided at a cost of perhaps 10s. or less.

If a knowledgeable tenant (or owner) points out the waste of fuel entailed and indicates his desire for an appliance in line with modern practice, costing perhaps £10-£15, (*a*) he is required to provide it himself and will be allowed only 7/10th of 10s. towards the cost (*c.f.* paragraph 27), (*b*) the Government tries to dissuade him from making the improvement by adding a thumping purchase tax or refusing reasonable hire-purchase facilities, or both.

No. 7:

" The cost of new appliances may in most cases be judged reasonable if it corresponds broadly with the cost of appliances installed in houses provided by local authorities."

This paragraph goes on to say that if really good appliances should have been supplied in local authority dwellings, such appliances must *not* be taken as the standard.

Here, irrespective of size of room, character of the house, etc., the standard of the council house is to be perpetuated. Since the council houses may have the ordinary inset open fire without restricted throat, the injunction is in practice to install the least efficient appliance that will burn coke.

THE SPREAD OF A.P. ACTIVITY

Air pollution, together with organized interest in its control, seems to be spreading more and more noticeably around the world. Elsewhere we describe some new reports from Canada and the U.S.A. Mr. Damon, the former Chief Alkali Inspector, has recently been in New Zealand to give advice on their problems. Industrial smog is reported from Mexico City, a mile and a half above sea level, and a " London type " episode is said to have occurred in Milan. Clean air legislation for Milan is being considered, and in February an air pollution convention was held at St. Vincent, organized by the Lombardy Section of the Italian Association for Hygiene, with Professor Augusto Giovanardi of Milan as its President. One of our own members, Mr. K. R. Johnson, has recently taken up the new post of Smoke Abatement Officer at Durban, South Africa, and in Australia there is talk of the need for a Clean Air Act similar to Britain's. Finally, subscriptions for *Smokeless Air* have been taken out for a number of organizations in China.

Administering a Smoke Control Area

by

W. R. McGrath, F.S.I.A., F.R.S.H.

Public Health Inspector, City of London

A Paper read to the South-East Division of the Society at a meeting on December 14th, 1956, i.e. before the publication of the official Memorandum on Smoke Control Areas.

ON the agenda paper of this meeting I am down to speak on the administration of a smokeless zone in the light of Sir Hugh Beaver's lecture to the Southport Conference of the Society. In point of fact Sir Hugh made only a passing, and not very important, reference to a proposed smokeless zone which was negatived by the Minister on the grounds that neither a sufficiency of smokeless fuel or approved appliances were available. That incident occurred some time ago.

It is my purpose, therefore, to consider only what is now legally described as a smoke control area, and to discuss, in a somewhat provocative way, the steps really necessary, in my view, to bring such an area into being.

A smoke control area may be visualized, not as an area entirely smoke-free, but as one where the emission of smoke is substantially reduced. An area in which the use of bituminous coal on domestic grates will be an offence, but in which furnaces and railway engines will be allowed to emit smoke of a light grey character.

It is possible, and may indeed be so, if the Minister exercises his power under Section 11 of the Act, to permit the use of bituminous coal in a domestic grate, if such a grate is capable of burning it without producing a substantial quantity of smoke. There are such appliances on the market and their use is to be encouraged while the present severe shortage of smokeless fuel continues.

Smoke will also be emitted in a controlled area if local authorities, as they have the power to do under the Act, exempt specified buildings or classes of buildings, or specified fireplaces or classes of fireplaces. From my own experience the only alternative to exemption was to put out of business entirely certain long established firms employing special processes which—in all the circumstances—would have been quite undesirable. Other sources of smoke emission in the area will include those caused by lighting up, those recurring from thermostatically controlled furnaces and from a number of other minor causes.

If to some of you this may appear to be a somewhat discouraging picture of what a smoke controlled area will be, I should add that the objective of the recommendations in the Report on Air Pollution was that by the end of ten or fifteen years the total smoke in all heavily polluted areas would be reduced by something of the order of 80 per cent. and that by so doing this would mean a freedom from air pollution which many parts of the country have not known for more than a century.

This brings me to the question which many local authorities might well address to themselves. Are we, in the terms of the Air Pollution Report, a

" black " area? If not, should we consider at all the question of the declaration of a smoke control area. If one draws a line from the Bristol Channel to the Wash, everywhere below that line (with the exception of London and its environs), and possibly Bristol, does not experience a high frequency of fog coupled with large amounts of pollution.

The Act provides plenty of scope for work in this large area apart from the declaration of smoke control areas. Certainly until such time as a vastly increased supply of smokeless fuel becomes available.

Staffing

May I now turn to the question of staffing. The Act places the responsibility for its administration on local authorities. The main burden of the work falls by Statute to the Public Health Inspector. I would interpolate here that it is to be hoped that local authorities will not depart from that statutory declaration. We do not want to be cluttered up with a lot of fancy titles such as Clean Air Inspector, Smoke Inspector, Smoke Abatement Inspectors, Atmospheric Pollution Inspectors, Smoke Observers and the like. The statutory title definitely identifies the problem of atmospheric pollution with public health—an aspect of the question which has always been, quite rightly emphasized.

I do not agree with Sir Hugh Beaver when he said in his lecture that we want somebody with a lower level of qualification. I could dilate on this subject but will content myself by saying that whilst the Public Health Inspector is familiar with many trades he is also master of one—a most important one in a free community—that of interpreting the requirements of the law to the citizen and enlisting his willing co-operation. The solution of the present staff difficulty is being found, and cannot be too long delayed, by the extended use of the articled pupillage system which has been adopted, or is in the process of being adopted, by many local authorities.

In any case there is good ground for believing that by a judicious redistribution of duties, and by a temporary relaxation of less essential routine work, Chief Public Health Inspectors may be relied upon to ensure that any necessary action required to be taken to secure a reduction in the emission of smoke will not be allowed to suffer by a temporary shortage of staff.

Surveys

Now may I pass to something which exercises my mind every time the question of smoke controlled areas comes up for discussion. From the beginning it has been dinned into us by all sorts of people, eminent and otherwise, that a detailed survey of the district *must* be made as an essential preliminary to the declaration of a smoke control area. It has been said so often that everybody accepts the contention without question.

Do local authorities need to embark on a time-consuming and expensive survey with all its attendant clerical appendages? Is it really necessary for a survey to be carried out to ascertain the number of dwelling houses and flats, business premises, shops, Public and Corporation premises, factories, schools, churches and other buildings? All this information should be fairly readily available in existing local authorities' records.

And then to record the number of heating appliances in use; those which operate smokelessly and those which emitted smoke.

And then to indulge in what accountants call " steeplechasing " to find out the number of grates which it is assumed will need to be replaced and the cost of such replacements. The figure of cost arrived at will, in all probability, be ultimately proved to be wholly fictitious especially since costs vary so frequently these days.

No local authority will be able to say with any precision that a given number of new appliances will be required.

Having done all this do we seriously contemplate the initiation of a series of discussions with owners and occupiers of premises to explain the provisions of the Act.

All these operations, together with others I have seen enumerated, appear to me (having regard to my experience in the City of London) to be quite unnecessary. If we are to proceed on these lines we shall be fifty not fifteen years before the objective of the Air Pollution Committee is achieved.

In my view there are three fundamental prerequisites to the declaration of a smoke control area, apart from the question of publicity and propaganda which is to be dealt with by Mr. Marsh.

1. To carefully choose a small area to be marked down as a smoke control area. The considerations which should govern that choice need not be gone into here, but there is room for some overall authority in London to plan these areas.

2. To ascertain the approximate annual solid fuel consumption in the proposed area setting out the numbers and types of premises divided into three or four categories, e.g. industrial, non-industrial, domestic and possibly Crown Property.

Against each of these categories there should be set out the quantities of the various fuels used, e.g. bituminous coal, anthracite and other Welsh fuel, coke; other smokeless fuel.

It should be made possible to obtain these details through the Regional Coal Controller or the Local Fuel Overseer of the Ministry of Power, or failing these the assistance should be sought of the fuel distributors in the proposed area.

The object of this exercise is the essential one of obtaining an approximate figure of the amount of smokeless fuel required to replace the bituminous coal used.

3. To take into consultation organizations such as the Solid Smokeless Fuel Federation, the Coal Utilization Council, the Combustion Engineering Association, the Coal Merchants Societies and similar organizations who can speak with authority on behalf of the manufacturers and distributors of appliances and fuels.

When all this has been done you will be getting some place and it will be possible to judge whether the time is ripe to proceed with the proposed smoke control area and to begin to make official contacts with the occupiers of premises in the area.

This should not be by means of a detailed survey or indeed a survey of any kind. You will have satisfied yourself that all the necessary tools are available to the occupiers to enable them to do their part of the job. A well drawn up circular or pamphlet can be circularized to all ratepayers concerned pointing out the obligation imposed upon them by the Act and informing them, if they are in doubt, where they can apply for advice or information to enable them to comply with the Act.

I am sure you will find that the non-profit, non-trading organizations such as the S.S.F.F. and the C.U.C., the technical staffs of the distributors of fuels and appliances, will all come to the aid of the local authority and will prove an immense help in advising occupiers on the best methods to adopt to comply with the Act.

Local authorities should not underrate the fact that our citizens are on the whole a law-abiding community, and that in this problem of solving atmospheric pollution will be found to be very co-operative. This is evidenced in the reports from those areas where smoke control is already established.

The provisions relating to adaptations of fireplaces and the distribution of cost are clearly laid down in the Act. The proper fixing of appliances is essential, and it is indicative of the initiative that Public Health Inspectors have taken in this matter, that more than 300 of them in and around London have, by the courtesy of the Coal Utilization Council, participated in special courses to top up their knowledge of the subject.

It should be recalled that adaptations must be carried out to the satisfaction of the local authority. To facilitate this owners or occupiers should be required to submit for approval a detailed specification of works and cost before the work is commenced.

Prior Approval

There are many aspects of the administration of the Act which could be enlarged upon but the time allotted to me is short. I would, however, like to comment on the question of the prior approval of furnaces under Section 3 of the Act.

Firstly, the question as to whether any particular plant is efficient in operation is one wholly for the occupier or owner on the advice of his consultant. Local authorities and their officers are not consultants on fuel technology. Every man to his trade. He would be a brave, or perhaps I should say a foolish, Public Health Inspector, who claimed to speak on level terms with a combustion engineer who has devoted his life to the study of all aspects of the appliance and fuel industry.

Secondly, our concern is wholly one of ensuring that a furnace is capable of operating without emitting smoke.

Whatever the fuel used it should be burned in accordance with well recognized and practicable conditions for preventing smoke emission.

These well-recognized and practicable conditions can be summed up in a few sentences as follows:

(1) The fuel used *must* be that designed for the equipment.

(2) The maximum designed load *must* not be exceeded.

(3) The apparatus *must* be under the supervision of an adequately trained operator, and wherever possible, automatic fuel burning equipment should be used.

(4) The apparatus *must* be efficiently maintained, and for this purpose must receive skilled attention at regular intervals by a recognized heating engineering firm who normally carry out maintenance contracts on installations.

(5) The apparatus *must* include an efficient smoke alarm of the Radiovisor, or other approved type, sited to ensure prompt rectification by the operator of any conditions which are giving rise to the emission of smoke.

Any approval sought to a proposal which lacked all or any of these elementary requirements should be sent back for the second thoughts of the proposer.

Many local authorities will be waiting impatiently for a pronouncement from the Minister on a number of points, e.g. Regulations to be made under a number of sections, and for a little more guidance or suggestion than the Act gives on the financial provisions relating to the adaptation of fireplaces in private dwellings. May we not also hope that, as Sir Hugh Beaver said in his lecture, a blueprint of the clean air programme for the next five years is in active preparation somewhere in Governmental Departments, and that the " black " areas may be given an early indication of the smokeless fuel which will be available to them in the next three or four years.

Courses on Air Pollution

An encouraging feature of the educational side of the clean air campaign is the number of courses held in technical colleges during the present winter on air pollution. The Northampton Polytechnic is holding a twelve lecture course, covering a wide field, and at the Borough Polytechnic there has been a course of eight lectures on liquid fuels and five on air pollution. At the Manchester College of Science and Technology a course of sixteen lectures has been held.

Hastings in October

The planning of the Hastings Conference of the Society on October 2nd to 4th is now in progress. Full details will be announced in our next issue, but in outline the conference will be as follows:

For the Des Vœux Memorial Lecture we are pleased to announce that Sir Graham Sutton, F.R.S., Director of the Meteorological Office and one of the world's leading authorities on such questions as the dispersal of pollutants in the atmosphere, will present the lecture on " Air Pollution and the Weather."

Two Conference sessions will be devoted to different aspects of the Clean Air Act—one on practical aspects of its administration and one on the Act from the viewpoint of the industrialist. A third session will discuss, in several papers, the problems of air pollution from road vehicles, preventive measures and the administration of the law relating to this problem.

On the social side there will be a civic reception by His Worship the Mayor of Hastings, and the popular informal " get-together " on the Tuesday evening before the Conference opens.

Invitations and registration forms will be sent out in due course.

Diesel Smoke Prosecution

A dairy firm of Lynn, Norfolk, were recently fined £5 by Downham magistrates for permitting one of their lorries to be driven while emitting smoke from the exhaust pipe. They had pleaded guilty. The driver of the lorry also pleaded guilty to driving the lorry while it was emitting smoke, but was given an absolute discharge on payment of 4s. costs. He had stated that he had reported the condition of the lorry to his employers but that they had taken no action.

Comment on our 100th Issue

We were pleased to receive a number of congratulatory messages and Press comments on our 100th issue—the Golden Number, as many called it. We print below some extracts from these notices, together with one personal note that we were particularly glad to have.

The hundredth number of the National Smoke Abatement Society's quarterly journal, *Smokeless Air*, sees the light of day obscured, over most of the country, by a fog made dark and deadly by pollution. Yet the society has good cause to congratulate itself, for this year has seen the enactment of a workable measure to bring to fruition the greater part of what it has been campaigning for in the last quarter of a century . . . . If the society keeps up the quality and vigour of its past leadership it may well succeed in fulfilling the hope expressed by the editor of *Smokeless Air*—that a two-hundredth issue will never be needed.—*Manchester Guardian.*

* * *

Resplendent in a gold and white cover, the quarterly periodical *Smokeless Air* celebrates its hundredth number with the current edition. The intelligence organ of the National Smoke Abatement Society, *Smokeless Air* is a well produced and thoroughly readable chronicle of the progress of the clean air campaign.—*Birmingham Post.*

* * *

As with the headmaster who has completed his century of teaching terms so may *Smokeless Air*, the journal of the National Smoke Abatement Society, take pride in its educational effort and leadership with the publication of its hundredth issue. Despite the problems of little money in the early days, and staff and paper shortages in immediate post-war years, it has pressed forward regardless of the hazards to an ever-widening audience who join it in its attack against industrial fumes and domestic dirt . . . . The success of *Smokeless Air* must lie in its ability to please the members of the Smoke Abatement Society but many, be they builders, ironmongers, houseowners or local authorities, can learn much from its words . . . . To all these purposes *Smokeless Air* has devoted itself for 27 years, under the guidance of one editor for the whole time. He and his team are to be congratulated on a splendid contribution to society and industry.—*Truth.*

* * *

It cannot be often that an editor looks forward with satisfaction to the decline and death of the journal over which he presides . . . But although we may look forward to the time of clean skies and clear landscapes, the time when a journal of this kind will not be needed so very badly, the educational work still to be tackled by *Smokeless Air* is piled high. Now that smoke abatement is being taken seriously in this country, the practical problems are likely to multiply, so that before it does slide off into a decline the journal might have to come out every month instead of every quarter.—*Bolton Evening News.*

* * *

The final number in 1956 of *Smokeless Air*, the official organ of the National Smoke Abatement Society, is the 100th issue of this important quarterly to be published. For much of its early life, the journal, like the Society, had to kick its way through the thickets of both apathy and antagonism. In these more enlightened times it is surprising to recall that smoke abatement, a reasonable hygienic and proper practice of fuel efficiency, was once dismissed as the eccentric

idea of a few cranks. The more widespread knowledge of the benefit to be derived from clean air arises largely from the effort of the Society. . . . —*Colliery Guardian.*

* * *

It is, indeed, a happy coincidence that the year just ended should have marked both the passing of the Clean Air Act and the publication of the one-hundredth issue of *Smokeless Air*, which has worked so tirelessly to achieve this end and the great benefits to the people of Britain which implementation of the new legislation will bring . . . . For there can be no question but that the Society has made a big contribution to what is now accepted clean air policy—as a perusal of some of the 99 back numbers of the journal bear out! And, as the two Ministers point out in their congratulatory messages to which we referred, the Society and its journal now move on to important new fields in further educating public opinion. *Smokeless Air*, it should be remembered, is unique among periodicals in being concerned solely with the problems of air pollution.—*Gas Service.*

* * *

It is particularly appropriate that the 100th issue of the journal should be published so soon after the passing of the Clean Air Act, which has been one of the major aims of the Society since their inception . . . . We trust that the Society will now have equal success in ensuring that the provisions of the Act are implemented.—*Local Government Chronicle.*

* * *

The messages of the two Ministers indicate that the Society has still a most valuable function to perform in educating the public and industry to the implications of the Act, and, judging from the Journal itself, the Society has no intention of allowing the work it has undertaken over so many years to lag, or to become any less enthusiastic, now that its goal is within sight.—*Builders' Merchants' Journal.*

* * *

The publication of the 100th number of *Smokeless Air* marks a landmark in the Society's history, for it comes at a time when the spade work put in by the Society in the past quarter of a century should at last be about to achieve substantial results. . . . Should it remain a quarterly, one is tempted to wonder whether *Smokeless Air* will work itself out of a job before it achieves its second centenary, but even if the present gross pollution of the atmosphere is overcome before then, it seems probable that as long as there is industry there will be the need for an independent watchdog to ensure that the air we breathe is not contaminated.—*The Builder.*

From a Letter to the Editor:

I have just been reading the "Golden Number" of *Smokeless Air* and congratulate you on the excellence of its production and on its contents as well. The hundredth number is an important milestone, but only those who knew the magazine in its early and less glamorous days can know how important. Smoke Abatement has had a long and tortuous journey . . . . The pity of it is that had the country had the courage to pass the Beaver Act thirty years ago, as it might have done, the ideal we seek would have been a reality now.

J. Johnstone Jervis.

(*Dr. Jervis, formerly M.O.H. for Leeds, was a member of the original Executive Committee of the Society, which made the decision to start a quarterly journal.*—Ed.)

The Electrical Power Convention

The ninth British Electrical Power Convention will be held this year at Eastbourne from June 17th to 21st, under the Presidency of Mr. J. Eccles, C.B.E., Deputy Chairman (Operations) of the Central Electricity Operation. (Mr. Eccles received a Knighthood in the New Year Honours List).

The theme of the convention will be "Electricity in the National Economy."

THE THERMAL INSULATION BILL

Mr. Gerald Nabarro, M.P., has followed up his initiative on the Clean Air Bill with what he rightly describes as a complementary measure—the Thermal Insulation (Industrial Buildings) Bill. In introducing the Bill in the House of Commons on January 30th, Mr. Nabarro pointed out that an uninsulated building may lose through leakage anything up to 50 per cent. of the heat that is fed into it for heating purposes. Between 1951 and 1956 we erected 215 million square feet of new industrial buildings, of which not more than 10 per cent. were thermally insulated against heat loss. N.I.F.E.S. had estimated that up to six million tons of coal equivalent a year are lost as a result of our failure to insulate thermally our industrial buildings—the productive effort of 20,000 miners.

The Bill, like Mr. Nabarro's Clean Air Bill, is supported by both Conservative and Labour members, and was due to have its second reading on March 15th.

The Bill, in its draft form, provides that no new industrial building " in connection with which any form of plant or equipment is used for the purpose of space heating shall be erected except in accordance with such minimum standards of thermal insulation as may be prescribed by the Minister in relation to any class of industrial building as aforesaid by regulations." For existing buildings, on and after the appointed day, which it is proposed should be not earlier than four years after the passing of the Act, " every industrial building in connection with which any form of plant or equipment is used for the purpose of space heating shall be thermally insulated in accordance with such minimum standards of thermal insulation as may be prescribed," etc. The proposed penalty is a fine not exceeding £500 and up to £50 for each succeeding day on which an offence is continued after conviction. Somewhat tentatively, we gather, it is suggested that the Act should be enforced by the local authorities.

Every step towards the better insulation of buildings, commercial and domestic as well as industrial, is of value to the clean air campaign, simply because of the reduction in fuel consumption that follows. We go to press before the Commons gives its verdict on Mr. Nabarro's Bill, but we hope that either this, or an even more comprehensive measure, may be in due course enacted.

New Course for Smoke Inspectors

The Royal Society of Health, which issues the Smoke Inspectors' Certificate, has approved a scheme for training candidates submitted by the College of Fuel Technology. The same method, part home study and part tutorial group meetings, is to be used as has proved so successful with boiler operators in the N.C.B. and N.I.F.E.S. schemes for the Boiler Operators' Certificate of the City and Guilds of London Institute. The course therefore includes practical instruction on different plants. Fuller information can be obtained from the College of Fuel Technology, 90 Talbot Road, Highgate, London, N.6.

Year Book

The Society's Year Book for 1957—which will be entitled Clean Air Year Book—is in course of preparation and should be received by members soon after this journal. We regret that there has been some delay, due to pressure of other work, in the issue of this publication.

The Information section of the Year Book has been further improved and the summary of legislation has been brought up-to-date. Members of the Society receive a copy free of charge. To non-members the price is 1s. 6d. or 1s. 8d. by post.

The West Midlands Campaign

After a Christmastide break the West Midlands campaign resumed its progress through the area with the exhibition visiting Wolverhampton on January 22nd and Coventry on February 3rd. Both of these appear to have been outstanding successes, largely because of the excellent organization and drive put into them by the local authority. The Wolverhampton exhibition was opened by Dr. R. Lessing, President of the Society, and at Coventry the principal guest and speaker at the opening ceremony was Sir Hugh Beaver.

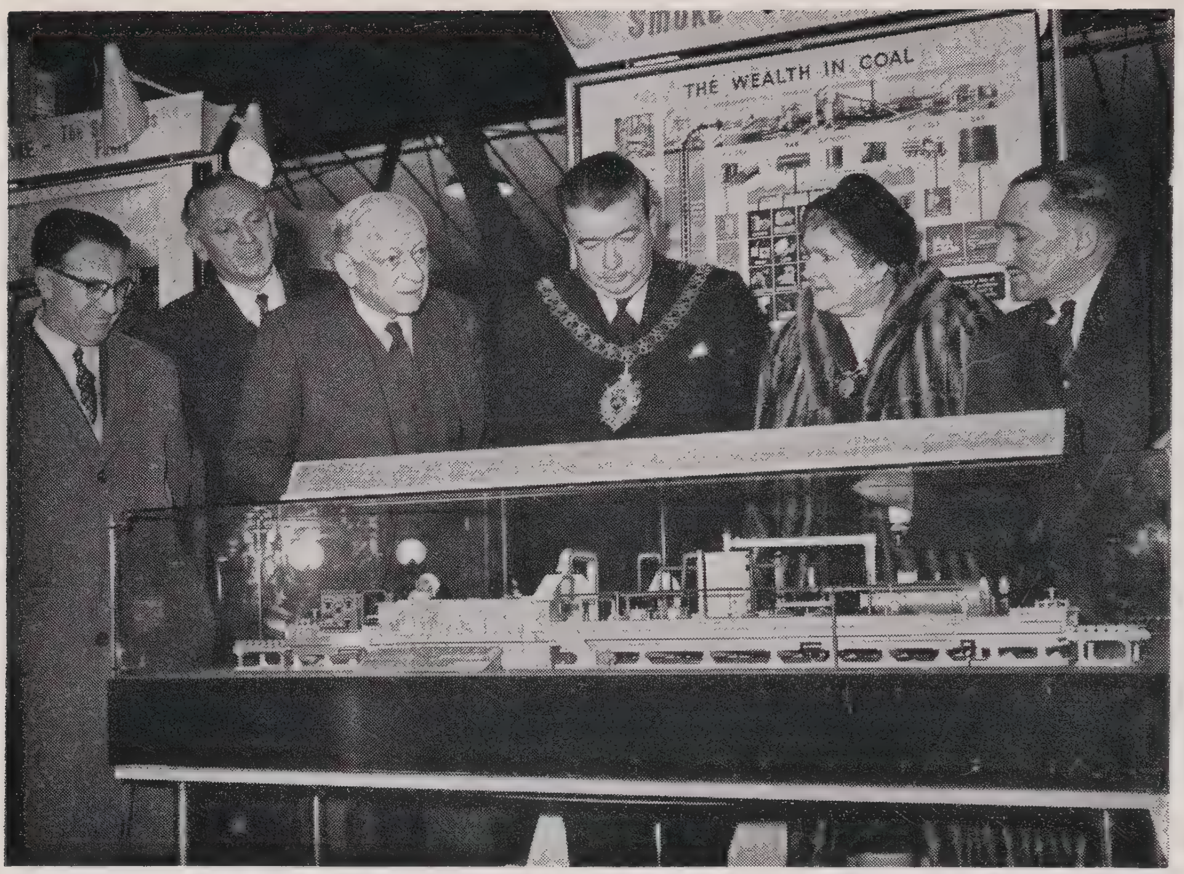
Dr. Lessing made an important point (which received wide press publicity) in his address, as follows:

" The damage done by air pollution is immense. Its annual cost was estimated by the Beaver Committee as at least £250 millions. It is already evident after only two years that this figure was an underestimate. The sub-committee on which I served thought it wise to exercise caution, so we did not feel justified to include the relevant charge which falls on the National Health Service nor indeed the monetary value of life itself. If compensation had to be paid in respect of that fatal week's 4,000 victims of the Great London smog the total would run into millions of pounds."

Sir Hugh Beaver, at Coventry, stressed the importance of the domestic chimney:

" In winter time more than half the smoke which went into the atmosphere came from the domestic chimneys. Coventry for example has about 80,000, many of which are adding

At the opening of the Wolverhampton Exhibition. Left to right are: Dr. J. F. Galloway, M.O.H., the Mayor, Alderman George Rastall, Mr. F. Binns Hartley, C.P.H.I., Dr. R. Lessing, N.S.A.S. President, and Alderman Mrs. R. F. Ilsley, Chairman of the Health Committee



At the Coventry Exhibition. Left to right are: Councillor R. Nickson, Vice-Chairman, Health Committee, Mr. R. Williams, C.P.H.I., Sir Hugh Beaver, the Lord Mayor and Lady Mayoress, and Councillor R. Looseley, Chairman, Health Committee. (Photo by courtesy Coventry Evening Telegraph.)

smoke to the atmosphere. This was a field for great activity in the battle to get clean air.

"Coventry," continued Sir Hugh, "could progress also by extending its smokeless zone—the first in the country. At present it covers only 30 acres in the city centre, and if the hopes of the Committee of which I was chairman, for clean air over all of Britain in 15 years, are to be realized, Coventry will have to extend its smokeless zone at the rate of more than 1,000 acres a year to keep pace."

The cleaning of a building in Wolverhampton during the exhibition week provided an object lesson on the cost of polluted air

The Mechanical Engineer and Clean Air

An Important Conference

A MOST successful technical conference on clean air was held in London on 19th to 21st February. Organized by the Institution of Mechanical Engineers, with the participation of a number of other institutions and associations (including the N.S.A.S.), it had as its theme "The Mechanical Engineer's Contribution to Clean Air."

Because of our press date we have been unable to include a descriptive account of the proceedings, but give below summaries of the sessional papers presented. These will show the wide scope and practical value of the conference, and it need hardly be stressed how valuable it is that the mechanical engineer should have had his attention drawn to the clean air campaign, and the part he can play, in this authoritative way. The Institution, and especially the conference organizing committee under the chairmanship of Captain W. Gregson, C.B.E., is to be congratulated and deserve the warm thanks of the clean air movement for their initiative and efficiency in organizing the event.

In addition to the papers recorded below an introductory lecture was given on the evening of Tuesday, 19th February by Sir Ewart Smith, on "Some Technical and Economic Aspects Involved in the Reduction of Atmospheric Pollution," and at the end of the closing session on Thursday afternoon a summary of the proceedings was given by Dr. G. E. Foxwell. We hope to be able to give a report on these contributions and on the discussions, in our next issue.

The conference was opened by the President of the Institution, Mr. T. A. Crowe, and the sessional chairmen were Captain W. Gregson, Sir Ernest Smith, Viscount Ridley and Sir Hugh Beaver.

List of Papers, with notes

SESSION 2

Paper 1. **The Efficient and Smokeless Combustion of Coal and Fuel Oil in Large Boilers.** *W. F. Simonson.* The paper outlines the role of the water-tube boiler in the national economy in terms of evaporative capacity, gross quantity of fuel consumed and of the qualities of the coal and fuel oil employed.

Its "clean air" record is discussed in relation to fuel constituents and characteristics which militate against efficient and smokeless operation.

The basic principles of smokeless combustion are outlined and reviewed in their application to the mechanical stoker, the spreader stoker, pulverized-fuel firing in dry-bottom and wet-bottom furnaces, the cyclone furnace and oil firing.

Some practical features of boiler design with the object of minimizing smoke and grit emission are briefly touched upon and the paper concludes by emphasizing the need for adequate instrumentation and skilled operation to give full effect to the boiler designers aims.

Paper 2. **Present Performance and Scope for Improvement in Power-Station Flue-Gas Washing Equipment for the Removal of Sulphur Dioxide.** *R. L. Rees.* A review of the methods of removing sulphur dioxide from power-station flue gases: the Battersea

effluent process which is in use at Battersea and Bankside Power Stations, where it is removing up to 95 per cent of the sulphur dioxide at a cost which, in a new power station, would be equivalent to an additional 8-10 shillings per ton of coal burnt; the Howden-I.C.I. cyclic lime process, formerly in use at Tir John and Fulham power stations, the cost of which at a new power station would be about 17s. per ton of coal according to the most recent computation; the Fulham-Simon-Carves process for making ammonium sulphate and sulphur by direct reaction of gas-works ammonia liquor with flue gases, now undergoing pilot plant trials at Nottingham power station; and other ammonia processes that were developed at Trail Smelter and are being considered for use in the United States of America, notably by the Tennessee Valley Authority. The removal of pyrites from coal is not generally feasible in Britain because of the very small size of the pyrites aggregates. The dry removal of sulphur dioxide from flue gases, which would not entail the cooling of the gas (a most serious defect of all flue-gas-washing processes because it causes the discharged gas to sink rather than rise) is being studied anew by the Central Electricity Authority, but presents formidable obstacles in engineering and chemical engineering design.

Paper 3. **Present Performance and Scope for Improvement in Power-Station Electrostatic Precipitators.** *J. S Forrest and H. J. Lowe.* The results of performance tests on electrostatic precipitators, and combined electrostatic and mechanical dust arrestors at power stations, are given, showing that the collecting efficiency at thirty stations commissioned since 1948 is from 95 to over 99·5 per cent with a mean value of 98·5.

It is pointed out that the present capital expenditure of the Central Electricity Authority on gas cleaning plant is £2·4 million per year.

The important features in precipitator design are discussed and information is given on operating experience.

Recent researches on precipitators and dust characteristics are mentioned and some of the results obtained from the Central Electricity Authority's pilot plants at Leatherhead and Croydon are given.

Future developments, and, in particular, improved methods of electrical control, are discussed, and an indication is given of the scope for overall improvement in plant performance.

Paper 4. **Mechanical Grit and Dust Collectors.** *J. C. Johnson and G. C. Goodwin.* The paper describes in general terms the nature of the dust with which collectors, as supplied to industrial furnaces, would have to deal, and outlines the methods usually employed to determine the dust grading.

The main types of mechanical grit and dust collector in general use are described under three main headings and the efficiencies, based on dust particle size, are indicated for the various types.

Typical dust burdens and gradings from different kinds of plant are assumed and the efficiencies and emissions for the various types of collector are calculated to indicate their suitability for each application.

Finally, some notes are included on the operation and maintenance of collecting equipment and the general requirements for site testing.

Paper 5. **Means for Preventing the Emission of Grit, Dust and Smoke from Coal-fired Industrial Boilers.** *D. C. Gunn and P. G. W. Hawksley.* The nature of smoke is very briefly described and references are given to reviews dealing more specifically with the fundamentals of these results and with its physical and chemical properties.

Various types of industrial boiler are considered and their propensities for smoke and dust emission broadly assessed; it is concluded that boiler type should not be of major importance in either case. In practice, however, differences in standards of

operation may suggest that certain kinds of boiler possess advantages in respect of smoke and dust emission, but it is emphasized that such advantages are not necessarily related to boiler design.

Firing appliance design is then discussed, and fuel beds are classified as overfeed, underfeed and composite. It is argued that the underfeed bed is the least likely to give rise to smoke emission.

Dust emission is considered and the conclusion drawn that operation factors such as fuel stability and quantity of excess air, as well as size of fuel, can materially affect dust carry-over.

The measurement of smoke density is dealt with briefly, but the extent of dust emission is discussed more fully, particularly from the point of view of difficulties to be encountered in practice. Finally, are given the order of concentrations of stack solids emitted from different kinds of boiler plant where no special standard of operation has been adhered to.

SESSION 3

Paper 1. **Dust Problems of the Iron and Steel Industry.** *M. W. Thring and R. J. Sarjant.* During refining, the open-hearth emits fine iron oxide fume, the emission of which is considerably increased if oxygen lancing is used. Electrostatic precipitators and Pease Anthony scrubbers have been used, but cleaning is very expensive and research on new methods is being actively pursued in the United States of America. The Bessemer also gives severe iron oxide fume and the problem of cleaning is even more difficult as the gases are not confined to a comparatively small flue. Bag filters, electrostatic precipitators and Pease Anthony scrubbers have been tried on arc furnaces and on cupolas. In the former case the comparatively small volume of gases makes the problem more soluble. Blast-furnace gas cleaning is highly developed, using systems which are economic because of the value of the clean gas. Research on heat-treatment furnaces indicates that for almost all steels the optimum combustion atmosphere is one with a very small excess air which produces slight oxidation of the metal, but avoids excessive decarbonization.

Paper 2. **Practical Aspects of Dust Control in the Cement Industry.** *E. Burke, J. J. L. Murray and K. R. Johnson.* The main dust control problem confronting the Cement Industry is the de-dusting of the large volumes of hot gases of high water content generated in the rotary kiln. To obtain the optimum collecting efficiency required electrostatic precipitators are normally used and their application is discussed from both the practical and theoretical standpoints in the first part of the paper. Other types of dust collector, which have been tested out in the industry, and other factors such as chimney design are reviewed in the second part of the paper and a cost analysis for the de-dusting of cement kiln gas is developed.

The paper concludes with a detailed account of the Alundum dust-sampling apparatus used for determining the dust concentration in cement kiln gases and the efficiency of dust collecting equipment.

Paper 3. **The Present Position and Scope for Improvement in Ceramic Works.** *A. T. Green.* In this paper is discussed the smoke abatement problem as it is affected by the Ceramic industry. After describing the nature and extent of the industry the author describes the use of coal fuel in the various branches of the industry and the changes that have been and are being, made to reduce the use of coal. Where coal is used, the methods of lessening the emission of injurious fumes and thus decreasing atmospheric pollution, with particular reference to conditions in Stoke-on-Trent are given.

The work of the British Ceramic Research Association and their recommendations are discussed.

The present position and future plans are briefly discussed. These include attention to detail in design

and operation of the kilns, including wider use of mechanical stokers and more replacement of intermittent kilns for specialized products by continuous ones as used for the production of ordinary building bricks in which all the fuel is fully burnt in the kiln and practically no smoke emitted.

Paper 4. **Air Pollution Prevention in the Chemical Industry.** *W. A. Damon.* This is an outline of the evolution of the chemical industry and the legislation which has been evolved to deal with the emissions of air therefrom. Methods for dealing with the more commonly encountered dangerous gases, sulphur oxides, hydrogen chloride, hydrogen sulphide, chlorine, oxides of nitrogen and fluorine, dusty or misty emissions and offensive effluvia are briefly reviewed. The paper concludes with notes on the dispersion of waste gases, the need for continuing research and the relations between the industry and the general public.

Paper 5. **Foundry Atmospheres.** *W. B. Lawrie.* The Joint Advisory Committee on Conditions in Iron Foundries published a report in 1947 which became known as the Garrett Report. Since that time a considerable amount of research and development work has been done in an effort to suppress dust and fumes in foundries. The work was undertaken to improve the atmospheric conditions inside the foundries, but this is almost a prerequisite of clean air outside because the dust and fumes, which are not controlled at source, will be discharged to the open air through doors and windows and the fans of the general ventilating system. Once they have been controlled at the point inside the foundry, however, they can then be passed through filters so that the air that finally escapes to atmosphere will be clean.

SESSION 4

Paper 1. **Air Pollution Research in Coal Mines and its Bearing on Air Pollution above Ground.** *G. Nagelschmidt.* A description of how, in the course of pneumoconiosis research, electron microscope techniques were introduced to observe and measure dust particles below 2 micron diameter in coal mine air. The character of the dust particles changed below 1 or 2 microns and it was possible to identify the fine dust as air pollution.

By using heat-stable specimen supports, combustible matter could be distinguished from ash and the temperature could be measured at which particles disappeared when heated in air. The mass concentration of solid matter as function of size could also be estimated from counts of the electron micrograph records. The techniques are applicable to the study of solid particles in polluted air in mines and above ground and may help in the study of air pollution.

Paper 2. **Air Pollution from Road Transport: Part I.** *A. Fitton.* The nature, composition of toxicity of exhaust gases from petrol and Diesel is described and the total pollution compared with that from burning solid fuel in domestic fires and industrial furnaces. The influence of engine and vehicle operation on the concentration of the toxic constituents in the exhaust gases is also shown. In general the exhaust gas from the petrol engine is most objectionable during idling conditions when the carbon monoxide content is high, whereas the exhaust gas from the Diesel engine is at its worst under high engine-load conditions, when the emission of smoke is at a maximum. Under these conditions the exhaust gas from both engines may contain the carcinogen 3·4 benzpyrene, but there is no evidence to show that they are responsible for any increase in lung cancer.

Various possible methods of reducing the atmospheric pollution caused by exhaust gases from road vehicles are outlined. These include good maintenance of engine and fuel injection or carburation systems, correct driving technique, derating of the

power-output of Diesel engines, improved control of fuel/air ratio, particularly during idling conditions, and finally the use of " after-burner " systems to complete the combustion of the fuel.

Air Pollution from Road Transport: Part II. The Operator's Viewpoint. *A. T. Wilford.* The subject of air pollution is discussed from the viewpoint of an operator of a large fleet of Diesel-engined vehicles. Whereas the internal combustion engine—by virtue of its efficiency and economy in the use of fuel—has in itself made a contribution to clean air, it is recognized that the rapid growth in the numbers of motor vehicles on the roads imposes obligations on all classes of user. Mention is made of the differing viewpoints of the three main types of user, namely, the private motorist, the goods-vehicle operator and the operator of public-service vehicles. The problem is not a new one for bus operators and reference is made to a system of standardization of carburettor settings and combustion control which was successfully introduced nearly 30 years ago.

The remainder of the paper is concerned with exhaust emission from Diesel-engined vehicles. The emission of objectionable exhaust products can be kept to an acceptably low level by ensuring that the recommended setting of the fuel-injection pump is never exceeded and by adopting a system of regular and skilled maintenance of the engine and its fuel-injection equipment.

Some reference is made to possible influence of fuel characteristics. Comments are also made on the devices which have been proposed, though not yet properly developed, for " cleaning-up " the exhaust products.

Air Pollution from Road Transport: Part III. Investigations in the Cause of Diesel Engine Exhaust Smoke Emission from Road Vehicles. *C. L. Bailey and E. S. Bates.* The paper considers the principal reasons for deterioration of exhaust condition in the automotive Diesel engine. The effect of malfunctioning of the fuel-injection system is discussed together with the significance of fuel volatility and ignition quality.

A detailed description is given of a sampling type of smoke-meter, rack-position indicator and engine-speed indicator, all designed to be used in vehicles on the road and to provide a continuous synchronized record of these three functions both during acceleration tests and steady speed running.

Road tests made using this equipment have clearly shown the significance, in terms of exhaust smoke, of changes in fuel quality and changes in fuel-injector performance. Exhaust condition has been studied over periods of up to 30,000 miles operation in order to establish the reasons for deterioration. This work was carried out on standard vehicles which were withdrawn from normal service for a limited period of test.

Air Pollution from Road Transport: Part IV. *B. J. Donovan, W. A. Mason, P. L. Orman and P. H. Daniels.* This paper describes the techniques employed and the results obtained when analyzing Diesel engine exhaust gases during the course of normal research into the question of fuel quality and performance. Details are given of analytical techniques used.

The possible factors contributing to exhaust smoking are examined in some detail. These are (1) fuel quality, (2) engine design, (3) engine operating conditions, (4) maintenance of injection equipment.

Apart from maloperation of an engine, it is shown that the most important cause of black smoke is malfunctioning of the injection equipment.

The results are given of the analysis of exhaust gases on the selected single-cylinder direct-injection engine in good mechanical condition and operated throughout the speed and load range up to, and slightly above, the smoke limited power level.

Aldehydes and oxides of nitrogen figures are shown to be below those reported for gasoline engines and, although small quantities of poly-nuclear aromatics were detected, only one sample of exhaust carbon contained 3 : 4 benzpyrene and then only in a concentration of 0·1 parts per million of the carbon collected. This corresponds to an emission of 0·01 micro-grammes per min. This figure is compared with published figures of 120 microgrammes per min. from a gasoline engine at zero load at a speed of 500 r.p.m.

Paper 3. **The Elimination of Smoke from Locomotives.** *R. C. Bond.* The smoke emitted by steam locomotives is the primary cause of air pollution on British Railways and the paper, therefore, deals in some detail with the causes of such smoke emission, consideration being given to the combustion of fuel in locomotive fire-boxes.

Methods of reducing air pollution by locomotives both at motive power depots, during periods of lighting up and on the road are considered and, whilst it is shown that much can be done to reduce air pollution by steam locomotives, complete elimination is not possible and the solution must therefore be sought in alternative forms of motive power such as electrification and Dieselization, which are analyzed in the light of the British Transport Commission's (B.T.C.) modernization plan.

It is shown that the biggest contribution to clean air is offered by electrification, the economic justification for which depends upon traffic density over the lines in question. Future plans for electrification are discussed and the use of other methods of traction for areas where electrification is not justified and during the interim period before electrification are also considered.

The paper shows quite clearly and in some detail that a progressive reduction in air pollution is ensured by the implementation of the B.T.C's modernization plan.

Paper 4. **Ships in Port.** *R. Atkinson and L. Baker.* The paper explains that the smoke nuisance from ships in port is not one of the major problems in obtaining clean air in industrial areas, but is one of the most difficult to tackle.

It places the cause of smoke nuisance into the five categories of occurrence on the day of arrival of a ship in port, the boiler operating at a reduced load, wear and tear of machinery, raising steam in coal boilers and conversion where natural draught is retained.

A survey of the existing conditions and regulations is then examined and the conscientiousness of regulations in different countries is commented upon.

The paper goes on to discuss the future application of the Clean Air Bill with possible loopholes.

Subsequently, the types of ship involved in air pollution are considered as applicable to coal-burning and oil-fired ships. The details of technical considerations as applied to the various types of machinery causing smoke are examined with comments on how this occurs.

The paper concludes with a conclusion and recommendations dealing with possible methods of improvement.

SESSION 5.

Paper 1. **Instruments and Automatic Control.** *Ll. Young.* The mechanical engineer has played his part in reducing atmospheric pollution through the design and use of instruments which measure in various ways the efficiency of combustion and automatic devices which control the efficiency of combustion.

While many of the instruments and automatic apparatus are the product of the mechanical engineer, others derive from the physicist and chemist and in this case the mechanical engineer has modified them to meet the requirements of the heat raising plant.

While analysis of the flue gases is a direct method of measuring the efficiency of combustion, it suffers from the need for the process to be

complete before measurement can be made. However, control of combustion through oxygen analysis is now being accepted more widely because of the improvements made in sampling methods and in the design of the apparatus.

Control from the direct measurement of the fuel/air ratio is frequently employed in the combustion of liquid and gaseous fuels. In the case of solid fuels, however, inaccuracies in the fuel measurement make the control from this method possible only if trimming from oxygen analysis is employed.

For many years control of combustion from steam flow/air flow ratio has been almost invariably employed. The method has survived as the most satisfactory means of combustion control in spite of its limitations.

In the case of the industrial plant employing small boilers, the relatively low cost of fuel compared with other raw materials renders uneconomic the use of a wide range of instruments. Therefore, combustion efficiency in such small plant relies largely upon the use of self-proportioning burners or upon present fuel/air ratio.

The various methods of measurement and means of determination of ratio are described and the paper leads to descriptions of the manner in which the ratio measuring device are used in different applications of heat raising.

Paper 2. **The Education and Training of Boiler Operators.** *A. MacFarlane.* The efficient operation of industrial boilers and furnaces would largely eliminate the emission of black smoke from factory chimneys and prevent a serious wastage of fuel.

Some headway has been made with the training of boiler operators but the number of men involved is probably in the region of 75,000, and only a small percentage has so far been trained as a result of the special courses organized by the Technical Colleges, the National Coal Board, the Central Electricity Authority and, more latterly, the National Industrial Fuel Efficiency Service.

The paper also reviews the courses provided for locomotive firemen by British Railways and the Royal Navy vocational training scheme for stokers about to leave the service.

There are signs that some managements, which offer incentive and bonus payments, have already taken notice of the advantages arising from the employment of trained operators, whilst the Clean Air Act may provide an impetus that will bring forward more men for training.

The paper concludes, however, that the problem is still not receiving the attention it deserves from industry.

DAME CAROLINE HASLETT

We regret to record the death, on January 4th, 1957, of Dame Caroline Haslett, C.B.E. Dame Caroline had a distinguished career in the field of engineering and more particularly as one who had advanced the merits of electricity among women, for the benefit of women and the home. She was Director of the Electrical Association for Women from its formation in 1924 until 1956, when ill-health compelled her resignation. Earlier, she had been the first secretary of the Women's Engineering Society.

Dame Caroline's rare pioneering qualities are best indicated by simply mentioning that, among other positions of distinction, she had been the only woman member of the British Institute of Management, Chairman of the Council of Scientific Management in the Home, a Companion Member of the Institution of Electrical Engineers, the only woman appointed to the newly created British Electricity Authority in 1947, the first woman chairman of the British Electrical Development Association, and a member on several occasions of the British delegation to the World Power Conference. She was a woman of uncommon ability who had vision.

Scientists at Charing Cross

The annual exhibition staged at Charing Cross Underground Station by the Solid Smokeless Fuels Federation, which has become a popular event, this year broke new ground in an interesting and instructive way. With the title " The Scientist at your Hearth " boldly emblazoned over the exhibition in the booking hall of the station, the exhibition not only showed smokeless fuels in use in different types of appliance, but contained an actual laboratory in which could be seen the rare sight of scientists at work. They were doing proximate analyses of fuels, testing for clinker formation, testing fuel for open convector fires and openable stoves for heat output. The laboratories could be entered or the work could be observed from the outside through windows.

The exhibition was opened on February 4th at a gathering in the adjoining Charing Cross Hotel by the Dowager Marchioness of Reading, G.B.E., who was introduced by the Chairman of the Federation, Sir Henry Jones, M.B.E.

The Right Fuel for the Job

The Combustion Engineering Association have published a revised second edition of the handbook *Firing Equipments and their Fuels* (7s. 6d.). This consists of notes on the different types of boiler furnace stokers, a description of the different types of fuel, and specifications of coals for individual types of stokers. The tables which comprise this latter part of the book will be useful to all combustion engineers and on occasion of value to Public Health Inspectors.

Municipal Engineering has been and is continuing to feature a clean air campaign in its columns. The series started with messages of appreciation from the Minister of Housing and Local Government, the Minister of Power, Dr. Lessing, President of the N.S.A.S., and others. The journal is covering a wide field and is featuring different aspects of the problem and the methods that can be used to solve it, in succeeding issues. It is an attractive and useful enterprise, on which M.E. is to be commended.

SMOKE CONTROL AREA NEWS

According to reports in the local press, a number of towns are now pressing ahead with plans for smoke control areas, generally under the new Act.

Birmingham

Encouraged by the reduction in air pollution deposit in the city centre since the introduction of the smokeless zone last summer, Birmingham Corporation is to introduce two new zones in the Broad Street and Lyndhurst areas. The former adjoins the present city centre zone and the latter is a new estate being built at Erdington. The figure of 23·84 tons per square mile for November last year, taken at a pollution gauge in the central zone, compares with the average November deposit of 43·02 tons between 1950 and 1954, including the exceptionally low reading of 17·70 tons in November, 1953.

Sheffield

On January 28th last, Sheffield Health Committee approved the city's first smoke control area. This area will comprise about 200 acres, including a cross-section of homes, commerce and industry. Having in mind the exemptions which may be granted under the Act, it is felt that the area is substantial with minimum conversion of present installations. There are 300 homes in the area.

In suggesting a programme for more control areas in other parts of the city, the Health Committee feels that as the prevailing winds are westerly and south-westerly, it would again be giving the greatest benefit to the greatest number by dealing with the areas between the city centre and the western and south-western boundaries—which would also benefit the eastern and north-eastern parts. Three further areas are suggested for later development. After the second control area is made, it is also proposed to make areas on individual housing estates.

Wolverhampton

Steps may be taken soon towards establishing a smoke control area in the centre of Wolverhampton. When the Wolverhampton Corporation Bill came before the House of Commons Select Committee six years ago, it was stated that the first smokeless zone in Wolverhampton would probably cover about 33 acres, including various types of establishment in the town centre.

Newcastle upon Tyne

Newcastle upon Tyne is ready to start its first smokeless zone of 118 acres in the centre of the city, including 13 acres covered by the central station and 10 acres of the river area. Six smoke inspectors are to be recruited to carry out a thorough survey, which is expected to take six months. There are about 1,500 properties in the area, mainly of a business nature.

South Shields

South Shields is likely to have a small smokeless zone in the Laygate redevelopment area. On December 4th last the Housing Committee decided to recommend to the Town Council that none of the 243 flats to be built in the Raglan Street area should be equipped with open hearths. Instead, the committee thinks that the flats should be all-electric. This follows from the enthusiastic report given by a delegation from the Committee which visited Kirkcaldy to inspect the electric floor-heating system in the Burgh Council's multistorey block of flats there.

Preston

On December 6th last the Preston Town Council approved the creation of a second smokeless zone. This is to be to the south of the present zone, and will stretch from Fishergate to the River Ribble. Again like the first zone, it will consist mainly of shops, offices and business premises, with a few small industries and ordinary dwelling houses. The bulk of the houses would have been in an area which is now demolished, and so the

conversion of the area will take very little time. The new zone, like the first, will be to the west of the town, and with the prevailing wind, the centre and easterly portion would get the benefit.

Bolton

At the next monthly meeting of Bolton Health Committee, the Medical Officer of Health, Dr. R. W. Elliott, and the Chief Public Health Inspector, Mr. T. Williams, would bring forward suggestions for a new smokeless area in Bolton, it was stated at a meeting of the Committee on January 30th.

Kilmarnock

The Medical Officer of Health for Kilmarnock, Dr. B. R. Nisbet, and the Chief Public Health Inspector, Mr. J. K. Baird, have suggested to the Health Committee that the town's new housing development area at Grange Farm should be the town's first smoke control area under the Clean Air Act. The Health Committee support the idea, and they are of the opinion that smokeless fuel grates should be installed at the estate and that the missives of let for the houses should have the necessary conditions incorporated. The committee will now ask the Housing Committee to support the suggestion.

Nottingham

Nottingham Corporation is to build 49 flats which will be heated and supplied with hot water from a district heating plant which will have sufficient capacity to supply a second block which may be built later. This system was contemplated when the Clifton smokeless estate was being built, but was dropped.

Derby

Tenants of houses on Derby's Sunny Hill Estate will be forbidden to burn other than smokeless fuel. The Town Council decided this on December 6th last, when it was agreed that a clause to this effect should be inserted in the tenancy conditions. Alderman H. A. Hind, chairman of the Housing Committee, said the committee had been asked by the Health Committee to declare one of the new housing estates as a smokeless zone, but this had not been done before, because the committee was not satisfied that the necessary fuel was available. The Estates and Housing Director had now been informed that there would be ample supplies of smokeless fuel for the future.

Oxford

A narrow strip in the centre of Oxford, from St. Giles in the north to Folly Bridge in the south, may become a smoke control area. The health Committee of the City Council are recommending that approval in principle be given to the establishment of the area. The area extends over 170 acres, and comprises mainly commercial and business premises, several colleges and about 100 houses.

Luton

Luton Town Council agreed on January 29th that the Chief Public Health Inspector, Mr. G. F. Macefield, should investigate the practicability of smoke control areas in the town.

Runcorn

A smoke control area is being considered by the Council's Public Health Committee.

West Bromwich

A Clean Air Council is to be formed in West Bromwich. The inaugural meeting will be held in the near future, and a sub-committee is envisaged, made up of housewives and householders from smoke control areas under preparation. Primary aim of the organization will be to foster an interest in the abatement and prevention of atmospheric pollution among employers and employees in local industries and among the residents. The Council will also consider difficulties experienced by manufacturers and residents, such as fuel problems and plant and equipment. Other points that the Council will consider are any difficulties arising in the establishment and extension of smoke control areas, and new developments in technique in relation to fuel consumption and smoke prevention.

One of the most important functions of the Council will be to report and make recommendations to the Hygiene and Cleansing Committee.

Camberwell

Dr. Chalke, Medical Officer of Health for Camberwell, has described in a special report some provisional plans for smoke control areas in the district. To begin with, an area in the north-west of Camberwell has been designated. This area contains the L.C.C. Picton Street housing scheme and also the borough council's Camberwell House site, so that a large proportion of it will consist of newly-built flats owned and controlled by a local authority.

Dr. Chalke then brings two other possible control areas to the notice of his council. One is in the Dulwich Village area going up to the Lewisham borough boundary. There is a similar area in the adjoining borough of Lewisham, which that council, if approached, might be willing to deal with in a similar manner. The other zone, in the Nunhead district and against the Deptford Council boundary, might similarly be made contiguous with a control area in the adjoining borough by inter-borough co-operation.

MORE L.A. ACTION ON THE CLEAN AIR ACT

In addition to consideration by local authorities of smoke control areas, reported above, many local authorities are now examining other ways of implementing the Act.

Wakefield and Leamington are already considering securing the new building byelaw. Action by Croydon is referred to in our editorial columns and in addition a publicity drive is to be started, and discussions are taking place with the statutory boards and with neighbouring authorities about the provision of smokeless fuels and the possible co-ordination of smoke control area schemes. The Medway towns—Rochester, Chatham and Gillingham—are reported to be co-operating so as to co-ordinate their schemes, and such joint action is also being considered by Wrexham Borough and Wrexham R.D. Councils.

Morley (Yorkshire) is setting up a Smoke Abatement Advisory Committee comprised of members of the Council, local manufacturers and representatives of Trades Unions. We understand that a committee on similar lines is also being formed in Hull.

Camberwell has appointed one of its P.H. inspectors as smoke inspector, and has carried out a survey of all industrial and domestic heating plants in the borough that have a capacity of 55,000 B.Th.U. per hour.

Local authorities in the Middlesex area are discussing the co-ordination of smoke control area schemes. Willesden has set up an Air Pollution Committee, which has been holding a successful series of public meetings, at which questions and complaints about specific instances of pollution have been invited. At a meeting held just as we go to press the chief speaker was Mr. Arthur Blenkinsop, M.P., and in the lively discussion which followed his address questions were answered by the Chairman of the Committee, Councillor S. C. Piddington, the Town Clerk, Medical Officer, and the Director of the N.S.A.S.

All the local authorities in Warwickshire (except Birmingham and Stratford-on-Avon R.D.C.) were represented at a recent meeting at Nuneaton, when it was decided to form a committee to co-ordinate the work of the authorities in the county in implementing the provisions of the Clean Air Act.

Note: The above notes, and those on smoke control areas, are far from being as comprehensive as we should like. The information is derived in the main from press cuttings received. May we appeal to Local Authority readers to send us direct news of any activities they would like to have reported?—Ed.

THE AIR POLLUTION HANDBOOK

New U.S.A. Publication

Air Pollution Handbook, McGraw-Hill Book Company, New York and London. $15 or £5 12s. 6d.

In the first place, since this 712 page volume weighs three pounds, it might have been more appropriate to call it a desk-book. It is big both in size and concept. It consists of 14 independent sections, by over thirty authors, under the editorship of Paul L. Magill, Francis R. Holden and Charles Ackley, who are, respectively, Senior Scientist, Senior Chemist and Editor of the Stanford Research Institute, California, with Frederick G. Sawyer, who is Director of Industrial and Public Relations to the Ralph M. Parsons Company, as Editorial Consultant.

The Handbook is an important addition to the rapidly-growing literature on air pollution. It naturally surveys the question from the American angle, which in some respects is rather different from our own. It is primarily a scientific study, and with one exception—the lawyer who writes the chapter on legislation—all the contributors are university or industrial scientists. It is surely an omission that there should be nothing from a government or municipal officer or other person concerned with the administration of the law or the formulation of policy.

The scope, and generally speaking the excellent balance, of the book can be shown by grouping the fourteen sections as follows. First there are two sections which review the subject in terms of the sources and source control of pollution, and as a factor in city planning and the location of industry. Then follow four chapters on what may be called the study of pollution within the atmosphere—its chemistry, physics, meteorological and visibility aspects. Thirdly, there are three short chapters on some of the consequences of pollution—on human animal and plant life. Next come chapters on the investigation or observation of pollution—sampling procedures and experimental test methods. The next chapter deals with equipment and processes for the abatement of air pollution, and finally there is a chapter on control by legislation.

Only 70 pages are given to discussing the effects of air pollution, and of these it may be noted that 14 pages are concerned with human health, 12 with farm animals and 44 with plant life. The animal section is concerned not with pollution generally but with the specific cases of arsenic, fluorine and lead poisoning. The chapter on the effects of pollution on plant life contains much useful information on the effects of sulphur dioxide on leaves, the effects of fluorine and other miscellaneous pollutants, including the new herbicides. It does not, however, refer to other important factors through which pollution adversely affects vegetation: the loss of sunlight, the action of deposits, particularly acidic deposits, washed into the soil and their deleterious chemical and biological effects.

Similarly, although the chapter on "The Epidemiology of Air Pollution" contains some interesting discussion on the general principles involved, mainly from an ecological standpoint, it does not survey the question comprehensively or succinctly enough to be a complete statement of the case.

Except for one brief reference there is no discussion on the economic cost of air pollution: a matter of importance if only because of the value of showing that it is usually cheaper to spend money on preventing pollution than to allow it to continue.

The chapter on the weather effects covers considerable ground in discussing atmospheric diffusion, the dispersal of gases from stacks and

multiple sources, etc. Those on the chemistry and physics of the atmosphere, and on visibility, are largely for the more specialist reader. The first chapter in the book, on air pollution sources and their control is of a general introductory nature but at the same time goes into much detail and discusses many localized types of pollution.

Abating Pollution

Perhaps from the British point of view the most useful chapter of all is that on "Abating Air Pollution," which covers 100 pages and is written by a team of ten authors. It contains much technical and scientific information on American practice, and its scope may be indicated by referring to its main divisions: the disposal of pollutants by dispersal and by combustion; the collection of aerosols—gas cleaning by various methods; the control or removal of gaseous pollutants, particularly sulphur compounds, fluorides and nitrogen oxides, by various methods. The printing of this section alone, as a small practical handbook, would have much to commend it.

The concluding section, on legislation, is of value to workers in this country largely because of the tabulations and analyses it gives of the provisions of American city and county ordinances. It refers to the only state legislation so far enacted: the Oregon Air Pollution Act of 1951. The author mentions that a significant trend is the popularity of proposing legislation at the state level either for the purpose of authorizing a survey and study, or for the purpose of establishing a statewide air pollution control agency. He also gives a warning of the dangers of too many agencies spoiling the broth.

Discussing control through reports and licences the author sums up the prior approval principle and refers to a new method for registering all sources of emission:

"Effective aid to industry with respect to air pollution, as well as control to be exercised for the public good, cannot intelligently be given or exercised unless the government agency charged with responsibility has knowledge of the facts. The fee and permit system, in which the operator must submit his plans for approval, is an attempt to supply these facts.

"Another method is to require registration of points of emission with the bureau in charge, whether municipal, county or state. Ilion and Herkimer, N.Y., have incorporated this concept in their new smoke abatement ordinance. The data to be given in either system would include:

1. Location of outlet.
2. Size of outlet.
3. Height of outlet.
4. Rate of emission from outlet.
5. Composition of effluent.

"The usual exemptions from registration would apply, such as single non-continuous emissions, accidental discharges, small units, etc. Other exemptions can be provided as needed in that area. When the agency charged with responsibility receives data respecting the points of emission, a pattern is readily established locating the probable trouble spots and permitting intelligent expenditure of time for constructive improvement."

From these brief notes it will be apparent that the only adequate way of reviewing this Handbook would be a series of reviews on each of its sections by an equal number of specialists. The overall impression is that the volume contains a vast amount of information that will be useful to the general technically-minded air pollution worker, the serious student and more particularly to those concerned with the scientific investigation of different aspects of the problem.

It must be mentioned that each of the fourteen sections contains a good, and in many cases extensive, bibliography to other work on that particular sector of the problem. Altogether, in fact, there are close on 1,500 references.

"The November Fog of London"

(*We are indebted to the member who "discovered" and sent to us the following verses*).

First, at the dawn of lingering day,
It rises of an ashy grey;
Then deepening with a sordid stain
Of yellow, like a lion's mane.
Vapour importunate and dense,
It wars at once with every sense.
The ears escape not. All around
Returns a dull unwonted sound.
Loath to stand still, afraid to stir,
The chilled and puzzled passenger,
Oft blundering from the pavement, fails
To feel his way along the rails,
Or at the crossings, in the roll
Of every carriage dreads the pole.
Scarce an eclipse, with pall so dun,
Blots from the face of heaven the sun.
But soon a thicker, darker cloak
Wraps all the town, behold, in smoke,
Which steam-compelling trade disgorges
From all her furnaces and forges
In pitchy clouds, too dense to rise,
Descends rejected from the skies;
Till struggling day, extinguished quite,
At noon gives place to candle-light.

O Chemistry, attractive maid,
Descend, in pity, to our aid:
Come with thy all-pervading gases,
Thy crucibles, retorts and glasses,
Thy fearful energies and wonders,
Thy dazzling lights and mimic thunders;
Let Carbon in thy train be seen,
Dark Azote* and fair Oxygen,
And Wollaston and Davy guide
The car that bears thee, at thy side.
If any power can, any how,
Abate these nuisances, 'tis thou;
And see, to aid thee, in the blow,
The bill of Michael Angelo;
Oh join—success a thing of course is—
Thy heavenly to his mortal forces;
Make all chimneys chew the cud
Like hungry cows, as chimneys should!
And since 'tis only smoke we draw
Within our lungs at common law,
Into their thirsty tubes be sent
Fresh air, by act of Parliament.

HENRY LUTTRELL (1770-1851).

(*Henry Luttrell was a wit, man of fashion and conversationalist as well as a versifier, in the Holland House circle. He sat in the Irish Parliament before the Union*).

* Nitrogen.

Review

Chemistry, The Conquest of Materials, by Kenneth Hutton (Penguin Books Ltd., pp. 228, with 26 plates, 3s. 6d.)

For the general reader, the student, and those concerned only with air pollution we can unreservedly recommend this new Pelican book by Dr. Hutton. For three main reasons: it is written in a refreshingly lucid and persuasive manner; it adequately covers all the basic groundwork of chemistry in a way that links it with everyday life—the essential provider of the materials on which our civilization rests; and finally because the chapter on fuels is one of the best outlines we have read on the nature of fuel, combustion, the manufacture of fuels, and the pollution of the atmosphere that results from its use.

The plan of the book is rather different from the conventional chemistry textbook. In the first, shorter part the reader is straightway given the basic facts with which the science is concerned—the elements, atoms and molecules. The second part then concerns itself with *materials*—materials for burning: fuels and food. Materials for protection:—clothes, fibres, plastics. Materials for protection against pain, and materials for attack—attack on disease, bacteria, dirt, moisture, weeds, etc. Materials for chemical industry, making other materials, and materials for scientific research.

The seven pages on air pollution in the fuels chapter are sound and to the point, and we were pleased to see quotations from *Smokeless Air* and other publications of the Society.

Bats Come Next

James Fisher, the well-known naturalist, told the National Audobon Society in New York that he considered man as the world's filthiest creature. Second on the list were bats. "Man," he said, "fouls his nest wherever he goes or lives." He polluted his sources of fresh water, the sea and even the air.

Technical and Trade News

Among publications received on new equipment, etc., the following are of particular interest.

The Sturtevant Engineering Co. Ltd. (Southern House, Cannon Street, London, E.C.4) have issued a new edition of their brochure on the *Preciptron* electrostatic air filter. This contains not only a technical description of the principles, operation and uses of the Preciptron, but has an informative section on air pollution, with particular attention given to the nature of the impurities suspended in the atmosphere. It also reproduces an excellent U.S. diagram that indicates the size range of typical aerosols, industrial dusts, etc., and the size ranges collected by different types of dust arrestor. The same company has also issued a new edition of their brochure on *Fans for Mechanical Draught* which again is informative and well-illustrated.

W. C. Holmes & Co. Ltd., of Huddersfield, have sent us a brochure on the Holmes-Rothemuhle Multi-Cell cyclone dust collector, now being manufactured and marketed by the Gas Division of the Company. This consists of a number of small cyclones in parallel, each unit consisting of two concentric tubes: an outer flue-gas cylinder with an impeller fixed at the inlet, and an inner clean-gas pipe. An intense swirl is imparted to the flue-gas as it enters the cell, causing the dust particles to be centrifuged to the annular collecting space. From this point the dust gravitates to hoppers below, while the clean gas is drawn through the inner tube to the outlet ducting. The complete collector comprises a honey-comb of unit cells welded together to form a compact and rigid structure.

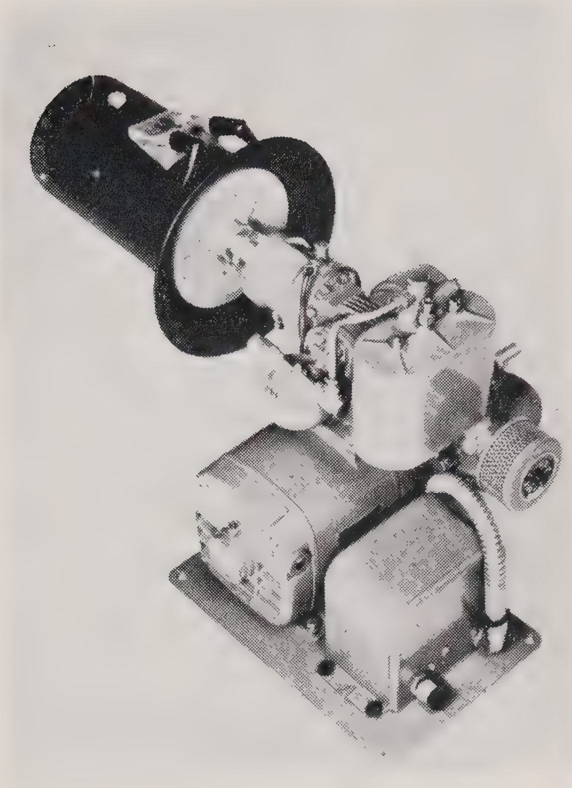
Ideal Boilers and Radiators Ltd. (Ideal House, Gt. Marlborough St., London, W.1) send information on a new No. 2 series Neo-Classic boiler, which is a larger model of the popular

The new Ideal Neo-Classic Boiler

No. 1 series. It is available in six sizes, with ratings from 65,000 to 135,000 B.Th.U. per hour, and has been designed with thermostatic draught control. Fins have been added to this series on various surfaces to increase the heating surface and particularly to improve the transmission when the boiler is used with an oil-burner. There are many other excellent features.

The boiler is totally enclosed in an easily cleanable jacket, as illustrated, in black and cream enamel, or at a lower price in a plain painted jacket. Prices range from £42 13s. 9d. (for oil-firing) upwards, according to size, finish and whether thermostatically controlled.

Shorrocks Superchargers Ltd. (Willenhall, Staffs.) draw attention, in view of the present fuel situation, to their S.D.2 and S.D.3 gas oil burners,



The Shorrocks Gas Oil Burner

which will operate on diesel oil, paraffin, TVO, CTF.50, filtered waste engine sump oil and (with slight modifications) waste transformer oil. The burner does not incorporate either an oil pump or small jet orifices, and relies on exceptionally good atomization which is secured by the fuel being first carburetted and then passed through two further stages of atomization. It is said that the overall efficiency that is obtained from these burners is greater than that of competitive burners of the pressure jet type. This is due to the complete atomization of the fuel and the entire lack of wastage due to smoke and carbon deposits caused by incomplete combustion and to the patented automatic damper which excludes all cold air from the combustion chamber during " off " periods.

Publications Received and Library Accessions

In the following selected list of books, reports and other publications received by the Society and " Smokeless Air " a price is given only when the publication may be purchased direct or from the Society or other bookseller. In such cases postage is extra.

London County Council: Annual Report of the Scientific Adviser for 1955. (L.C.C., County Hall, S.E., 1s.).

Allegheny County Bureau of Smoke Control: 7th Annual Report of Activities, for year ended May 31st, 1956.

City of Toronto: Air Pollution Advisory Board Report, for 1955.

Journal of the Air Pollution Control Association, November, 1956. (Quarterly). Formerly *Air Repair*. A.P.C.A., 609 Station St., Wilmerding, Pa., U.S.A.

Smog News. Published by the American Society of Mechanical Engineers, 29 West 39th St., New York 18, N.Y., U.S.A. $6.00 per year, 24 issues.

Proceedings of Conference on Chemical Reactions in the Urban Atmosphere. Edited by L. H. Rogers. Report 15. Air Pollution Foundation, Los Angeles, 704 South Spring Street, Los Angeles 14, Calif. U.S.A. $5.00.

Analysis of Air Near Heavy Traffic Arteries. N. A. Renzetti. Report 16. Air Pollution Foundation, Los Angeles. $1.50.

The Economic Use of Industrial Fuel Oils. J. T. B. Bookey. Reprinted from the *Steam Engineer.* (John D. Troup Ltd., 90 High Holborn, London, W.C.1. 6s.).

Smokeless Fuels Supplies

In the House of Commons on January 24th, **Mr. Norman Dodds** asked the Parliamentary Secretary to the Ministry of Fuel and Power what progress had been made in producing smokeless fuels; and the prospects for the immediate future in this respect.

Mr. Renton: Supplies of smokeless fuel are sufficient in total to meet demand at the present time and are likely to remain so in the immediate future.

Manchester's Clean Air Policy

Gas or Electricity for Central Heating

Manchester City Council has approved in principle a report of its Central and Parliamentary Committee which proposes that, in the interests of clean air, the central heating system in new public buildings should be operated by town gas or electricity, and that the same policy should be applied when installations in existing buildings are replaced.

One of the main factors leading to this recommendation is that if solid fuel or oil is used in such installations provision must be made not only for the elimination of smoke but also for the dispersal of sulphur dioxide, which makes it necessary to erect high chimneys. The report refers to a recent case in which the Manchester Regional Hospital Board submitted to the Corporation a proposal for a new heating installation at the Christie Hospital. The new installation would be a coal-fired boiler plant, and the Council's approval was sought to the erection of a chimney about 96 feet in height. The Board contended that, if operated efficiently, the new plant would be substantially smokeless, but they agreed that a high chimney was necessary to disperse the sulphur dioxide resulting from the combustion of the coal. The town planning and buildings committee however objected to the erection of the proposed chimney on the grounds of amenity and the Council agreed with them.

It is, therefore, urged by the committee that wherever possible central heating installations in large public buildings should use town gas or electricity to achieve the following objects:

(i) the elimination of smoke;

(ii) the elimination of sulphur dioxide; and

(iii) the need to build or maintain large chimneys would be obviated.

The proposal relates only to public buildings under the control of the Corporation and does not extend to houses or flats.

One paragraph from the report raises another matter of general interest:

" We now wish to refer to an incidental matter to which our attention has been drawn. The Education Committee have recently submitted to the finance committee proposals for converting the central heating boilers at ten schools from gas to oil firing. The proposals have been made by the education committee in response to an approach by the Ministry of Education who have urged local education authorities to take energetic steps to secure substantial savings in fuel costs and have pointed out that savings could be incurred by the conversion of central heating installations from gas firing to oil firing. While it is true that the Beaver Committee have suggested that in order to release or conserve coke for domestic use, it may be desirable to convert those central heating installations which burn solid smokeless fuel into oil firing installations, nowhere do they suggest that gas installations should be converted to oil firing. In view of the fact that fuel oil discharges into the air about twice as much sulphur dioxide as coal and coke, we think that it would be a retrograde step to convert to fuel oil those central heating installations which at present use town gas, which is virtually free from sulphur dioxide.

F.B.I. Handbook

The Federation of British Industries has issued an attractively printed Handbook on the Clean Air Act—described as " a guide for industrialists." The outline of the Act that is given is concise and clear and is in a somewhat more condensed form than the Society's *Summary*. It is published by the F.B.I. at 21 Tothill St., London, S.W.1, at 2s.

CLEAN AIR WITH LIQUID FUELS

Two Recent Papers

A well-attended meeting of the Manchester Association of Engineers, with members of the Northern Branch of the Institute of Petroleum, in Manchester on January 25th, 1957, discussed the problem of air pollution with particular reference to the use of oil. After an introductory address on the Clean Air Act and its implications by the Director of the N.S.A.S. the following papers, each slightly abbreviated, were presented. The discussion was opened by Mr. W. B. Kennedy, Smoke Abatement Officer, City of Manchester.

FUEL OIL AND CLEAN AIR

by

K. H. Sambrook, B.Sc.Tech

Although recent events in the Middle East have temporarily slowed down the planned increase in the use of fuel oil in this country, the hard fact remains that if the growth of our production is to be maintained, the increased energy demand can only be met with the help of fuel oil. It is, therefore, of interest to see what effect the increased use of petroleum fuel is likely to have on our efforts to reduce atmospheric pollution.

According to the D.S.I.R. the percentage responsibility for atmospheric pollution today can be apportioned roughly as follows:

Domestic fires	41
Factories	34
Railways	17
Miscellaneous	8

The proportion of petroleum fuel to coal used in these categories during 1955 was approximately as follows:

	Assumed coal equivalent	*Per cent.*
Domestic heating	2:1	3
Factories (excluding steel) ..	1·7:1	14
Railways (shunting locos)	12:1	1·5
Miscellaneous ..	1·7:1	15

Turning now to the future, the long-term plan for the railways is to electrify those lines where the traffic density makes it economical to do so and to employ diesel electric locomotives as an interim measure and where electrification could not be justified. These developments together with the use of diesel locomotives for shunting should practically eliminate the emission of smoke by railways.

In the domestic field the effect of oil firing is unlikely to be large since, although the fully automatic or semi-automatic oil burner is finding increasing favour with householders, it generally replaces smokeless fuels such as coke or gas. The smoke from domestic premises arises from the open coal fire to which we as a nation are so attached and for relief from the pollution which it causes we can only look to the adoption of the much more efficient, if less convivial, closed stove and to the greater availability and use of smokeless solid fuels. Petroleum is assisting in the drive to make available more smokeless solid fuel through the employment of oil gasification plants by the gas undertakings. The quantity of water gas manufactured fell by 14 per cent. in 1955-56 as compared with 1954-55, and the quantity of coke consumed in the gasworks fell during the same period by nearly 300,000 tons. The use of oil gasification plants is likely to increase considerably in the near future and, together with the utilization of reformed refinery gases, should enable much larger quantities of coke to be made available for sale instead of being utilized for gas production.

A small contribution towards atmospheric cleanliness should result from

the increased popularity of kerosene stoves, mainly of the portable variety without flues and hence necessarily smokeless. To a large extent they are used instead of electrical or gas burning appliances simply because gas or electricity is not available at the spot where the heat is required. But they are also used on occasions when, otherwise, a coal fire would be lit, and it is particularly during the lighting period that the open coal fire gives off the maximum quantity of smoke.

The greatest impact of the increased use of fuel oil will be in industry for steam-raising and for direct process heat and also for the central heating of large buildings, such as office blocks and hotels. It has been stated that if our rate of production is to be maintained, it will be necessary within the next five years for one industrial boiler in four to use fuel oil. With reasonable care in the choice of equipment and in its proper operation and maintenance, these industrial oil-fired plants can be run without the emission of visible smoke.

Some twenty years or so ago, the instructions issued by a manufacturer of oil-burning equipment might have contained some such words as these: "Having set the oil valve to the rate required the air regulator should be adjusted so that just a trace of light smoke is emitted from the stack. Heavy smoke indicates an insufficiency of air whilst a clear stack indicates a wasteful excess." Today we regard even the lightest visible smoke from the stack of an oil-burning plant as being a social crime and we avoid wasteful excess of air by providing better means of measuring our combustion efficiency than cocking an eye at the top of the chimney. This question of measurement is the crux of the matter and every industrial oil-burning plant should be provided with, firstly, means of indicating the onset of smoke well before it has reached the stage at which it is noticeable at the chimney top, and secondly, a means of indicating the quantity of excess air being supplied (generally by a carbon dioxide meter) since on this depends the thermal efficiency of the plant.

A good oil burner, or for that matter a good combustion appliance with any fuel, is one which will give complete combustion with the minimum of air in excess of the theoretical requirements. The quantity of excess air being used can be measured by means of a CO_2 meter; the measurement of complete combustion is not so easy if one wishes for something rather more accurate than judging the density of visible smoke. When burning fuel oil in the normal type of oil burner the fuel in the flame suffers thermal decomposition leading to the formation of a vast number of very small particles of carbon which give the flame its characteristic luminous appearance. In order that these carbon particles may be completely burnt to carbon dioxide, three things are necessary:

Firstly, there must be sufficient air to supply the oxygen;

Secondly, the air and the fuel must come into contact,

Thirdly, the temperature of the mixture must be maintained until combustion is complete.

Unburnt carbon in the flue gases is a sign of incomplete combustion and can be measured in several ways, of which the two most generally employed are:

(1) the reduction in intensity of a beam of light passed through the flue gases by the absorption or scatter of the light by the carbon particles;

(2) filtering the gases through a porous membrane and measuring the intensity of the stain produced.

The first method is the most readily applied to a continuously indicating instrument suitable for everyday use in a boiler house; the second method is convenient for laboratory and field tests where a spot check only is required. An instrument working on the filter principle was developed about twelve years ago by the Shell Oil Company in the U.S.A. and has

since been made commercially available. The instrument causes a sample of gas to be drawn under standardized conditions through a filter paper and the colour of the spot on the paper is compared against a standard scale having shades numbered from 0 white to 9 almost black. This is a very sensitive instrument and for example when burning a distillate fuel such as gas oil a number 6 Shell smoke number must be reached before the slightest trace of smoke is visible at the chimney. With heavier fuel oil the corresponding smoke limit takes place at about a number 7 Shell smoke number. To give an idea as to how this compares with the methods of smoke measurement with which some of you may be familiar and used by factory inspectors, a number 7 Shell smoke number corresponds to about number 1 on the Ringelmann chart and a number 2 Ringelmann corresponds to a number 9+ Shell smoke number. Taking a number 5 Shell smoke number as being the limit of which should be produced from a good oil-burning installation the corresponding amount of solid matter in the flue gases expressed as a percentage of the weight of fuel burnt is for distillate fuel, e.g. gas oil, 0·06 per cent. and for heavy fuel oil 0·38 per cent. These quantities may also be expressed as concentration of solid matter in the gases, the corresponding figures being for the distillate fuel 16 grains per 1,000 cu. ft. and for the heavy fuel 100 grains per 1,000 cu. ft.

The manner in which the amount of solid matter in the flue gases varies with the proportion of excess air fed to the burner is a good guide to the burner's performance. In the case of the good burner the smoke number remains at a low value until the excess air is reduced below about 20 per cent. and for a further reduction the smoke value begins to rise at first slowly, then more rapidly. In the case of the poor burner, the smoke number is rather high even with a considerable quantity of excess air and rises to above the acceptable limit whilst the excess air is still 50 per cent. or more above the theoretical value. This latter behaviour is a sign of poor air regulation and mixing, leading to a deficiency of air in portions of the flame although there is an excess of air on the average. Similar states of affairs can exist if the flame is chilled before combustion is completed by contact with cold surfaces or by the infiltration of large volumes of cold air.

These investigations are concerned with the measurement of smoke below the visible limit as a measure of oil burner efficiency and insofar as atmospheric pollution by smoke is concerned, this can be said to be negligible in the majority of oil-fired installations. Smoke can be made if the equipment is carelessly handled but it can be avoided in practically every case. Should the user of an oil-burning plant find difficulty in operating it smokelessly, then the equipment is either faulty or incorrectly applied and the advice of the manufacturer should be sought immediately.

The ease with which fuel oil can be controlled makes it particularly suitable for the application of automatic regulation and the increasing use of oil burning appliances operating on either fully automatic or semi-automatic systems eliminates the possibility of misadjustment of the burners with manual control.

Visible smoke is not the only source of atmospheric pollution which includes the emission of ash and gaseous products. As regards ash, the burning of oil fuel results in a very low emission since the quantity of ash by weight in fuel oils varies from negligible in the case of the distillate fuels used for domestic heating to something less than 1/10 of 1 per cent. in the case of the heaviest grades of fuel oil marketed. Moreover, not all this ash is carried out of the chimney and in most boiler installations a considerable proportion of the ash is trapped in the boiler and collected when the tubes and flues are cleaned.

Turning now to the gaseous products from the combustion of fuel oil,

the picture is not so favourable as in the case of the solid matter due to the fact that the fuels originating from the Middle East, on which we are so largely dependent for the increased quantities required, are characterized by a high sulphur content which in the case of the heavier grades may reach between 3 and 4 per cent. In considering this figure, one must reckon that because of its high calorific value, controllability and other advantages a ton of fuel oil will replace from $1\frac{1}{2}$ to 2 tons of coal depending on the application and even more in some cases. Hence a sulphur content of 3·5 per cent. in heavy fuel oil is equivalent as regards the emission of sulphur dioxide for a given duty for a sulphur content of 1·75 to 2·3 per cent. in solid fuel. These figures are within the range of the sulphur contents of our solid fuels but, on the average, conversion to oil firing will result in some increase in the amount of sulphur dioxide discharged into the atmosphere. Although a great deal of investigation has been carried out into the possibility of removing sulphur from fuel oil, no process has yet been discovered which will do so at anything approaching an economical cost. Nor is it practical to remove sulphur dioxide from the flue gases except by the most elaborate and expensive washing equipment such as that installed at the Bankside Power Station of the Central Electricity Authority. The provision of gas washing plant is out of the question for industrial boiler installations but harmful concentrations of sulphur dioxide in the atmosphere can be avoided by designing chimneys and siting them in relation to their surroundings so that the gases are discharged at as high a level as is practical and are well dispersed.

During the combustion of fuel oil a small proportion of the sulphur dioxide formed is oxidized further to sulphur trioxide in the flame and possibly by catalytic oxidization in the plant itself. The sulphur trioxide combines with water to form sulphuric acid. The proportion of sulphur dioxide converted to trioxide varies with the combustion conditions but does not generally exceed 4 per cent. The problems arising from the presence of sulphur trioxide in the combustion gases are mainly those of corrosion which can occur in portions of the plant, the temperature of which lies below the acid dew point. Means are available for avoiding these deleterious effects either by inhibiting the corrosion or by neutralizing the sulphur trioxide. The elimination of sulphur trioxide is, however, of little account insofar as atmospheric pollution is concerned, since the very much greater volume of sulphur dioxide, although relatively harmless in the dry state, will combine with atmospheric moisture to form a weak sulphurous acid and by subsequent oxidation sulphuric acid.

The quantity of solid matter in the flue gases from an oil-fired plant is small and the major portion of the unburnt carbon as it leaves the furnace is in the form of particles having a diameter in the order of 1 micron or less together with a few larger particles having sizes up to perhaps 100 microns (1/10 of a mm.) consisting of the remains of droplets of the atomized fuel which have not been completely burnt to gaseous products. Particles of these sizes are invisible to the naked eye and for practical purposes will be distributed in the same way as the gases so that with good chimney design the concentration in the atmosphere will be very small. In certain circumstances, however, and for reasons which are not yet fully understood, some of these fine particles come together to form aggregates of considerable size which we term "smuts." These may be $\frac{1}{8}$ in. in diameter or more and in calm air are deposited in the vicinity of the chimney. When they originate from the burning of heavy fuel, they are generally found on analysis to contain a substantial proportion of sulphuric acid so that the smuts can cause corrosion of materials on which they fall. The causes of smut formation and ways of preventing their emissions

from the chimney are being very closely investigated at the present time and it is hoped that means will soon be found of avoiding this nuisance which occurs only in some installations. Although the evidence is not conclusive, there are strong indications that cold chimney walls such as occur with an unlined metal stack may be a major factor in promoting the formation of smuts. The surface of the upper part of an exposed unlined metal chimney will almost invariably be below the acid dew point (about 300°F) and very often below the water dew point (about 120°F). The result is that the inner surface of the chimney becomes wet with sulphuric acid and acts as a flypaper to catch the carbon particles in the gases coming into contact with it. Deposits build up from which portions break away, particularly when changes of load cause an alteration in the temperature levels in the chimney. As an immediate measure, therefore, one can recommend that bare metal chimneys should be avoided in installations burning heavy fuel oil or where such chimneys are in existence, should be lined with an insulating refractory or alternatively insulated externally.

To summarize, the quantity of solid matter emitted from the chimney of an industrial oil-fired installation is extremely small, and for practical purposes fuel oil may be regarded as a smokeless fuel. The use of fuel oil in one industrial boiler in four should, therefore, make a very significant contribution to the campaign for clean air. The increasing use by the gas industry of oil gasification and refinery gas reforming plant will also assist by releasing for sale larger quantities of smokeless solid fuel.

THE CONTRIBUTION OF PETROLEUM PRODUCTS TO AIR POLLUTION

by

C. A. Roast, A.M.I.E.E., M.Inst.F.

It is on record that in 1257 Queen Eleanor moved from Nottingham to Tutbury Castle " to escape the unendurable smoke from sea-cole." Whilst this may have been an isolated case of air pollution, the degree of smoke nuisance in this country increased to such an extent that in 1819 a Committee was appointed by Parliament " to enquire how far persons using steam engines and furnaces could erect them in such a manner less prejudicial to public health and comfort." The first shipment of a petroleum product, i.e. kerosene, arrived less than 100 years ago and it is therefore established that air pollution problems prevailed in this country long before the birth of the oil industry. This should not, however, be taken to imply that the combustion of liquid fuels derived from crude oil is always achieved or for that matter, is possible, without some atmospheric degradation.

Kerosene Burning Appliances

Most of us are familiar with the flueless type of convector heater that burns kerosene, particularly as tens of thousands are helping to provide a comfortable standard of warmth in many homes. There is a limit to the burning rate of kerosene flueless appliances that can be used in a room if a reasonable degree of comfort is to be maintained, and this rate will be governed by the volume of the room and its ventilation. Whilst there is no clearly defined limit, it is suggested that an output of 10,000 B.Th.U's per hour (i.e. a burning rate of about half a pint) should not be exceeded unless the ventilation is quite good. If a

kerosene burning rate of half a pint is maintained, roughly 0·65 lbs. of water vapour will be liberated every hour. An analysis of the room atmosphere will reveal relatively small volumes of CO_2 and trace amounts of carbon monoxide and oxides of nitrogen are so low as to be almost negligible.

Gasoline-driven Vehicles

The efficiency of the combustion process employed in converting the chemical energy in gasoline into mechanical energy for driving a vehicle, will depend upon a number of variables. The mechanical condition of the car, the rate at which it is being driven and the competency of the driver will all contribute to the overall performance. An exhaust gas analysis would reveal CO_2, H_2O and CO with traces of unburnt hydrocarbons, aldehydes, oxides of nitrogen and sulphur. These compounds will vary quantitatively according to the degree of completeness of combustion achieved in the engine. There is no published evidence available in this country defining to what extent the exhaust gases from gasoline-driven cars contribute to our air pollution but it is generally held that in relation to the total air pollution problem, gasoline driven automobiles play a very minor part.

Diesel Engine Vehicles

Diesel engines are becoming increasingly popular for heavy vehicles and there is no doubt that some are capable of emitting smoke or soot particularly when overloaded or in a poor mechanical condition. There are a number of contributory factors to the emission of smoke or soot from these heavy vehicles, one of which is suggested as being partial cracking of the fuel but in all probability, the lack of a reasonable standard of engine maintenance is mainly responsible. It is estimated that from 0·5 to 1 per cent. of the diesel fuel used in road vehicles is emitted as smoke but vehicles probably vary over a wide range, say 0·1 per cent. for well maintained units, to 3 per cent. for others. A casual inspection of the heavy passenger transport vehicles operated by some of the bigger undertakings such as London Transport, etc., will reveal that other than for short periods when starting from cold, smoke emission from the exhaust pipe is not inevitable for this type of vehicle. However, the magnitude of the total air pollution from diesel engines is very small indeed compared with that resulting from the incomplete combustion of solid fuel in industrial and domestic fires.

There is little doubt that a distinction must be drawn between the invisible (gaseous) and the visible (particulate) pollutants derived from the combustion of all types of fuel. The most important gaseous impurities are sulphur oxides and the amount of sulphur removal from the fuel that is possible will be influenced by physical and economic considerations.

Of all the petroleum products, heavy fuel oil alone contains more sulphur than that of its thermal equivalent of coal and as Mr. Sambrook has previously stated, removal of the sulphur is possible, but very expensive. In most applications, fuel oil displaces much more than its thermal equivalent of coal and therefore on balance the SO_2 emission is not necessarily of a higher order than with coal for the same useful work.

Of the visible (particulate) pollutants, the figures published in the Beaver Report absolve liquid fuels from any measurable contribution. This advantage of oil can perhaps be illustrated by the fact that the method employed in burning liquid fuels incorporates an atomising process. The burning equipment transforms the fuel into millions of tiny droplets sufficiently small for complete combustion within the furnace. As the ash content of the heaviest grade of fuel used for industrial applications rarely exceeds 0·05 per cent., the quantity of stack solids emitted in comparison with that from a solid

fuel burning installation is negligible.

The Beaver Committee reported that by putting into effect their recommendations we would find in ten or fifteen years an 80 per cent. reduction of the total smoke in all heavily populated areas. Their estimate reveals that approximately 40 per cent. of the visible air pollutants comes from industrial and miscellaneous solid fuel-burning installations, about 25 per cent. from power stations and railways, and 35 per cent. from domestic premises. Of these three main sources of air pollution we can anticipate some improvement from the electrification and dieselisation programme of British Railways.

The main air pollution problem is centred around industrial and domestic solid fuel burning installations. The Potteries is a notable example of the effect of visible pollutants from industrial coal burning plants upon the surrounding atmosphere and a short film (which was shown) illustrates the chimney top conditions typical of coal-fired ceramic kilns and some oil-fired kilns producing the same type of ware in the same area on the same day. The next scene, of an oil-fired ceramic works in the Bournemouth area, shows that other than for a faint haze, the chimney tops are clear.

If it was possible to replace all the coal used for domestic purposes with kerosene and other distillate fuel oils and burn them in suitable appliances, an interesting set of conditions would be created. The current domestic smoke and grit contribution to air pollution would be almost entirely eliminated and on the assumption that kerosene or a 35 seconds fuel would be used according to the size of the premises, the SO_2 emission would be reduced by at least 90 per cent. In effect, the use of oil would reduce the degree of atmospheric pollution attributed to domestic coal usage by about 90 per cent. The Beaver Committee stated that if the total smoke in all heavily populated areas could be reduced by 80 per cent we would have a degree of freedom from air pollution not experienced in this country for more than a century. There can be no doubt that some atmospheric degradation from the burning of solid or liquid or gaseous fuels is inevitable but all the evidence available indicates that in comparison with the air pollutant emission from solid fuel burning appliances, the contribution from the combustion of petroleum products is negligible. In fact, if it was physically and economically possible to dispense entirely with coal and use oil instead, the annual discharge of 2·0 million tons of pollutants into the atmosphere in the form of smoke, would virtually cease.

Underground Gasification Plans

The N.C.B. are going ahead with the development of underground gasification and a pilot plant should be in operation by the end of 1958 at Newton Spinney, near Barlborough, on the borders of Yorkshire and Derbyshire. The gas will be delivered to a 5 megawatt generating plant which will be built by the C.E.A.

The coal seam chosen for gasification is of secondary quality and is not worth mining because of its high ash content. The country has considerable reserves of coal of poor quality and it is hoped that underground gasification may provide a means of using this national resource.

Some 5,000 tons of coal have already been gasified in a series of experiments conducted by the Ministry of Power and the National Coal Board. The most promising techniques, which will be used in the pilot scheme, use horizontal boreholes in the coal for carrying both the gas and the air needed for gasification. In one of the techniques, holes are bored in the coal connecting two galleries; in another the holes are blind and they contain a pipe that conveys air and steam to the reaction, and the gas returns outside the pipe.

BRADFORD'S SMOKE ABATEMENT STORY

This paper, by the Chairman of the Amenities Committee of the Bradford Civic Society, Mr. R. J. Steele, was read at a recent meeting of the N.S.A.S. Yorkshire Division in Bradford. We reproduce it because of the picture it gives of one community's past struggle against air pollution, and also because it shows how valuable, in this field as in many others, a live and responsible Civic Society can be.

As most of those present are visitors to our city, my contribution towards today's proceedings is in the nature of a historic survey.

Mr. A. R. Byles, of the family who founded the *Bradford Observer*, writing in the Handbook of the British Association when that body visited Bradford in 1900, tells us something of the smoke consciousness here as early as 1793.

In that year, a man named Buckley bought some land in Manchester Road and was about to erect a mill in which he proposed to install a steam engine. (Only eight years after the first Watt Engine).

A number of influential gentlemen got together and jointly threatened him with " all the terrors of the law " (whatever they were in those days) if his steam engine should be found to be a nuisance. This opposition was too much for Mr. Buckley, who gave up the project and removed to Todmorden.

Five years went by, when Messrs. Ramsbottom, Swaine and Murgatroyd proceeded to erect a mill in the Holme (I presume this is near the present Holme Top Mills). The inhabitants still looked with disfavour upon these projects, and would have liked to prevent them. The mill was, however, completed in 1800, and a 15 h.p. engine was installed. Various mills were built in 1801-2-3, all for mechanized spinning.

By 1810, Bradford had five mills with a total of 250 h.p. By then, the Industrial Revolution was well under way, and there was plenty of opposition to the introduction of machinery, but this was due to the fear in the minds of the working classes of what we are now calling automation. What I want to make clear is that the earliest opposition to the steam engine came from the people who objected to smoke.

Bradford became a borough in 1847, and public health matters which had been very sketchily dealt with by the Lighting and Watching Commissioners were taken much more seriously by the new Corporation.

In 1867, the first Smoke Inspector was appointed and he had 591 smoke-producing furnaces, burning 2,500 tons of coal per day to watch. It is recorded that on receipt of the Inspector's report the Council took the drastic step of giving the manufacturers a month's notice to abate the nuisance. Unfortunately the surrounding local authorities failed to co-operate, so the Bradford Corporation reported all these local authorities to the Local Government Board.

How far, therefore, Bradford had a hand (as it often has done) in stimulating Parliamentary action, I cannot say, but the fact is that in 1875 the Public Health Act was passed. This banned only black smoke, the penalty for which was 10s.

It was not until 1927 that ten neighbouring authorities joined with Bradford in obtaining Government approval for an Order limiting the emission of black smoke to three minutes in any half hour.

Before I leave this ancient history, I find it interesting to note that it was the Bradford City Council Smoke Prevention Committee that in 1869 recommended the purchase of the gas works from a private company. It was the Gas Committee which in

its turn created the Electricity Works—the first municipal power station in the country and that was in 1889.

Bradford, then, has been smoke-conscious since 1867.

Such records as I have been able to find have been mostly of the recognition of the problem by Public Authority. The only instance of unofficial recognition I know of is that of the opposition to the first steam engine in 1793. This is not to say that the public were apathetic in days gone by. When I came to the Yorkshire College (now Leeds University) in 1899, Professor Julius B. Cohen was a great worker in Leeds for cleaner air, and I have no doubt whatever, that he had his supporters in Bradford.

As far as I know, no attempt to focus public opinion on the smoke nuisance was made until the formation of the Bradford Civic Society. In 1947, the Amenities Committee, of which I have the honour to be Chairman, set out to investigate the problem. It had many sittings, and took evidence from numerous experts, eventually publishing its findings under the title of *The Black Plague*. This report gave the people of Bradford many details concerning the 9,385 tons of deposits that fell on the city of Bradford in 1938. The source of pollution was attributed to 90,000 private houses and 360 mill chimneys; and the report dealt impartially between the sins of the domestic users and the shortcomings and the waste of the industrialists. It pressed for the adoption of modern grates and smokeless fuels in private houses, and it supported the Corporation in its policy of installing smokeless grates in housing estates in course of erection.

It pleaded for the greater support of the Boiler Firer's Classes that had then been running at the Technical College for 15 years. Further, it strongly advocated the raising of the status of trained boiler firers in order that a better type of operative could be attracted to this occupation. It further suggested some scheme of efficiency bonus as an incentive. The report also, now that the war was over, recommended that rigorous inspection be resumed, and that heavier penalties should be inflicted on proved offenders.

Copies of this report were sent to every member of the Civic Society and a copy was sent to the user of every mill chimney in Bradford. It was also widely publicized in the local press.

Following the issue of this report, frequent contributions to the local press were made, with the object of keeping the subject before the minds of the people.

In January, 1954, the Civic Society sponsored a Smoke Abatement Conference held in the large hall of the Bradford Technical College.

This was attended by the Chairman of the Yorkshire Council of your Society, the Chairman of the Health Committee of the Bradford Corporation, and numerous public officials and representatives of industrial concerns. The subject of smoke abatement in connection with boiler plant led naturally to reference to the class for boiler firers' held at the Technical College. It is gratifying to be able to record that after this conference, the number of men sent to the firers' classes was very substantially increased.

The Bradford Civic Society is now 15 years old. It is one of forty societies up and down the country that have come into being either (i) through a love of the countryside and a desire to preserve beautiful and historic places from the hands of jerry builders or other despoilers of natural beauty, or (ii) to deal with the Housing, the Traffic, or general Amenity Problems that have come into existence concurrently with the growth of large cities and industrial towns.

Bradford has a magnificent list of things in which she has led the country. *She was the:* First City to buy out Market Rights from the Lord of the Manor, to adopt Child Feeding for needy scholars, and in the provinces to start a municipal nursery school and a municipal hospital.

I could name a dozen more.

I say all this in recognition of Bradford's keen sense of civic responsibility. I say this because of my admiration of the way this has worked out in the past and is still operating today.

All the same, there are many who feel that there is room for a society such as ours whose function is—working outside the City Council—the creation of enlightened public opinion and the presentation of that opinion to the powers that be.

We are strictly non-party-political, and we certainly are not a mere Keep-Down-The-Rates Society. In any large community there are bound to be many people (men and women), who have a vast fund of knowledge in one line or another that affects our corporate life and yet have no desire to engage in the hurly-burly of municipal politics. A society such as ours may attract this type of person, and thereby we may serve a useful purpose by helping to create the right kind of public opinion.

We believe we can be a friendly help to Local Government by encouraging and maybe sometimes even enabling them by the crystallization of public opinion to translate the best thinking of our time into corporate action. Bradford has already secured a pure water supply. The Civic Society is out to do all it can to hasten the time when we can rest content as regards the air we breathe.

So many of the reforms that some of us envisage as goals towards which we must continue to strive, will only be reached when public opinion has been educated up to a certain level, and in no sphere is public education more needed than in the campaign in which you gentlemen are engaged—namely that against the *black plague*

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The Landmark

CHEMICAL REACTIONS IN THE ATMOSPHERE

Los Angeles Conference

The report has been received of the Conference held in February, 1956, at Los Angeles on " Chemical Reactions in Urban Atmospheres." The Conference was sponsored by the Air Pollution Foundation with the cooperation of the American Petroleum Institute and the National Science Foundation. There were five sessions.

A. J. Haagen-Smit discussed the oxidizing power of the Los Angeles atmosphere during periods of smog. Oxidant concentration rises to a maximum during the middle of the day, and, when certain levels are reached, widespread eye irritation, plant damage, rubber cracking, and reduced visibility occur. Characteristic smog manifestations have been produced in the laboratory by the reaction of ozone with gasoline or olefins and by the irradiation of organic compounds in the presence of oxides of nitrogen. Ozone is formed during the photochemical reaction of organic compounds and nitrogen dioxide in low concentrations and may be measured by physical methods, such as the cracking of rubber strips. The ozone-forming capacity of various compounds differs; the olefin, butadiene, is the most active, followed by butene and pentene. The assumption is made that the free radicals formed during these photochemical processes react with oxygen to form peroxidic radicals, which, in turn, may oxidize another molecule of oxygen to ozone. A chain reaction mechanism is postulated to account for the formation of high concentrations of ozone.

R. D. Cadle reported on studies of dark reactions that may occur in Los Angeles smog, reactions involving smog itself, and photochemical reactions using highly purified Los Angeles air and relatively simple systems of contaminants. The rates at which dark reactions occur and the products formed were investigated for systems involving ozone, nitrogen dioxide, and nitric acid vapours in combination with paraffins, olefins, acetylene, gasoline, and sulphur dioxide. The course of the reactions was followed by two techniques: chemical analysis of samples withdrawn from a reaction chamber, and absorption of the reactants and products in a recording infra-red spectrometer. Whereas the velocity constants for ozone-olefin and ozone-gasoline dark reactions were sufficiently high to be considered important to the smog problem, the reaction rates of ozone with paraffins or sulphur dioxide and of nitrogen dioxide and nitric acid vapours with olefins were either too slow to be measured or too low to be significant. Ozone reacts exothermically with olefins to form products termed "ozonates," which exhibit prominent hydroxyl and carbonyl absorption bands. The photochemical formation of ozone in irradiated samples of Los Angeles night air was measured by means of a continuous oxidant recorder, and an attempt was made to identify the " oxidant precursor." Nitric oxide is shown to have a significant effect upon oxidant formation during the photolysis of nitrogen dioxide in the presence of certain hydrocarbons. The results of photochemical studies of highly purified Los Angeles air and relatively simple systems including nitrogen oxides and various hydrocarbons indicate that the amount of ozone formed by photolysis of low concentrations of nitrogen dioxide in air agrees with the amount predicted from rate data obtained at higher concentrations.

Infra-Red Spectrometer

William E. Scott described a long-path infra-red spectrometer that was used to study photochemical reactions of air pollutants at low concentrations. When a mixture of nitrogen dioxide and 3-methylheptane in oxygen was irradiated, the products observed were alkyl nitrate, alkyl nitrite, formic acid, and ozone. The rate of formation of ozone from 3-methylheptane and nitrogen dioxide was studied over a range of concentrations of both reactants. A transitory formation of ozone by the photolysis of nitrogen dioxide in oxygen was demonstrated, and it was shown that if the fast back reaction between ozone and nitric oxide is suppressed by the addition of nitrogen pentoxide to react with the nitric oxide, the ozone will quickly accumulate in the system. The photochemical reaction of nitrogen with a series of organic compounds is reported. Butyraldehyde, biacetyl, methyl ethyl ketone, 1-pentene, and 2-pentene all formed ozone when irradiated with nitrogen dioxide in oxygen. Butyl alcohol produced a small amount, whereas benzene and butyric acid gave none. Infra-red analysis of the products of the reaction between nitrogen dioxide and an organic compound frequently revealed, in addition to bands of known compounds, several unidentified absorption bands, which apparently belong to a single compound designated as "Compound X." Physical and chemical properties of Compound X indicate that it is an acyl-nitrogen compound; however, its structure is not unequivocally determined.

J. G. Calvert reviewed photo-activated reactions on solid surfaces as background for evaluation of the possible contribution of particulate matter to smog-forming reactions. The photosensitized reactions of various metallic compounds are discussed and the general characteristics of solid photosensitizers are summarized. Of the major metallic constituents present in the Los Angeles atmosphere, only lead and iron compounds are important from the standpoint of photosensitized reactions in the near ultraviolet absorption region. Speculations are made concerning the form in which these two metals may exist and their possible contribution to smog-forming reactions.

P. A. Leighton discussed the relation of the rates of photochemical primary processes to the diurnal variation of oxidant concentration. Assuming that oxidant is formed by a photochemical process and removed by a dark process, an approximate equation may be derived for the rate of change in oxidant concentration. Rates are calculated for certain absorbers present in urban atmospheres. Calculated and observed variations in oxidant concentration are compared, and the significance of the comparison is discussed. The individual terms of the equation for the rate of change of oxidant concentration are discussed.

"Members Mail."

The clean air campaign received further useful television publicity on 3rd January last, when the Chalk Farm railway smoke problem was examined on I.T.V. The programme was the first in a series entitled "Members Mail," designed to show the kind of problems which are brought to a Member of Parliament in his post-bag.

Mr. Kenneth Robinson, M.P., for St. Pancras North, was introduced by Mr. Daniel Farson of Associated Rediffusion. Mr. Robinson described how the Chalk Farm Tenants Association, through their secretary, Mr. S. A. Edmonds, wrote to him last year complaining angrily about the smoke and its effects. The programme then continued with interviews, including a number with local residents, and terminated with scenes of Mr. Robinson addressing an open-air meeting in Chalk Farm.

SMOKE PREVENTION ABSTRACTS

274. United Kingdom Fuel and Power. Haber, L. F. (J. Inst. Fuel, February, 1957, **30,** 65). The paper examines the country's past and present supplies of coal, gas, electricity and fuel oil, and its future requirements, particularly the added contribution which oil and atomic energy will be called upon to make. Coal production cannot be quickly increased and atomic energy will not be available on a significant scale before the end of the 1960s. Consequently very substantial quantities of oil have to be imported. The paper also describes changes in the pattern of consumption, notably the gradual shift from coal to gas and electricity, and some of the economic problems of the fuel and power industries. The situation in Britain is compared with that in other countries and attention is drawn to some aspects of overseas public utilities which might profitably be studied here.

275. Approval Tests for Coke-burning Domestic Appliances. Baker, W. A. D. (Paper read to the Inst. Fuel, January 2nd, 1957). It has long been the practice in the gas industry to list coke-burning appliances that attain specified performance standards under defined test conditions. Indeed, the list known as the Handbook of Approved Coke Burning Appliances (now in its 4th edition) was first issued in 1938 and introductory notes were given for the sections dealing with each class of appliance stating the expected requirements. The compilation of this list was part of a clearly defined policy with the object of improving the performance of these appliances and making their operation easier and more convenient. To encourage such improvements it has been necessary from time to time to review techniques of measurement and to revise test methods and performance standards. This paper deals with two such investigations which are of particular importance at the present time, namely, the comparison of methods of measurement of the radiation heat output, and the development of a more convenient and accurate method for assessing the performance of appliances incorporating convection.

276. The Rise of a Hot Waste Gas Plume. Bosanquet, C. H. (Paper read to the Inst. Fuel, February 13th, 1957). It is assumed that when a cloud of hot gas is rising the total heat content and total upward momentum are unaffected by dilution with atmospheric air. It is also assumed that the upward momentum increases at a rate proportional to the heat content. Rate of dilution is assumed to be proportional to the surface area of the cloud multiplied by a function of the wind velocity and the velocity of the cloud relative to the surrounding atmosphere. From these principles an equation is developed for finding the track of hot waste gas rising from a chimney in a wind of any velocity. The height to which the waste gas rises depends on both its heat content and its exit momentum and tables are given for calculating the combined effect. It is shown that if the temperature gradient in the atmosphere is less than adiabatic the smoke will not continue to rise indefinitely but will eventually settle down at a definite height.

277. Maximum Gas Concentration at Ground Level from Industrial Chimneys. Best, A. C. (Paper read to the Inst. Fuel, February 13th, 1957). The ground level concentration of gas emitted from a chimney reaches a greatest value at a particular distance downwind from the chimney. Both the distance and the concentration itself depend upon the design characteristics of the chimney and upon the meteorological conditions. If the height to which the plume of gas rises above the chimney, owing to heating or velocity of efflux, is known, the maximum concentration likely to occur in any weather conditions can be calculated. It is this maximum concentration which is of interest when the stack is being designed. Several formulae for computing the height of rise have been published. The results of using three of these formulae have been considered and it is shown that for the purpose of computing maximum ground level concentration the three are in reasonable agreement.

278. Britain's Growing Needs of Energy. Hartley, Sir Harold. (*Fuel Economy Review*, 1957, Fed. Brit. Indus.). The amount of energy consumed *per capita* is an index of the average income of our country and its standard of living and today there is a general recognition that the safeguarding of future energy supplies is a primary consideration of national policy. The author discusses Britain's needs of energy, the future of the coal industry, the processing of coal, and the future of electricity, atomic energy and

oil. He concludes by stressing the importance of the savings that can be obtained from fuel efficiency. Considerable savings will be made compulsory by the Clean Air Act.

279. Some Practical Aspects of the Clean Air Act. Hurley, T. F. (Fuel Economy Review, 1957, Fed. Brit. Indus.). In this article an attempt is made to outline the main causes of smoke and grit emission, and to suggest possible remedies from the angle of the factory owner with a boiler plant of small to medium size. It may be said that many boilers and their firing equipment appear to have been designed and operated with a complete disregard of the principles of smokeless combustion, and that it may involve some trouble and expense to provide a remedy. In some cases this may consist merely of modifying the method of operating the existing plant; in others the equipment itself will require to be improved; and, in extreme cases, it may also be necessary either to install additional plant or to make major modifications.

280. A Modern Development in Fly-ash Handling. Taylor, R. A. (Fuel Economy Review, 1957, Fed. Brit. Indus.). As solid fuel fired steam raising plants have increased in size, so the problems of handling and disposal of the associated ash and dust have become more acute. The provisions of the Clean Air Act (1956) have imposed further problems in this field. It is not only required that smoke shall be reduced to a minimum but, under section 6, no new furnace or oven burning pulverized fuel or solid fuel at the rate of one ton an hour or more shall be used unless the plant is provided with approved equipment designed o arrest grit and dust. In the 1956 edition of the Fuel Economy Review, equipment designed for the separation and collection of ash was described. This article deals with three methods of handling and conveying ash to the disposal point, and discusses some economic methods of its disposal or use.

281. Examination of Plans for New Industrial Chimneys. Nonhebel, G. (The Sanitarian, February, 1957). At whatever height smoke and flue gases are discharged, gravity will eventually bring the larger particles of grit, dust and soot to the ground. Moreover, because of the natural turbulence of the atmosphere, which mixes the flue gases with the main body of the air stream passing over the earth's surface, a proportion of the gases and of the freely suspended fine particles will reach the ground although they are not affected by gravity. The higher the point of discharge and the greater the total heat content of the discharge, the more widespread will be the dilution of the gases and fine particles by the time any reach the ground by diffusion. This article discusses these points and relates them to the duties of local Authorities under the Clean Air Act.

282. Air Pollution and the Clay Industry. (Claycraft, 1956, **29**, 355). A report of the opening of a new atmospheric pollution recording station at Stoke-on-Trent. Discusses briefly mechanical stokers, the firing of blue goods in intermittent kilns, and the fixing of the Belgian type continuous kiln; 388 tunnel kilns and 48 intermittent gas fired and electric ovens have been recently built in the British pottery industry. (D.S.I.R.).

The Domestic Heating Conference

The Institute of Fuel has now published Volume II of the Proceedings of the special conference it held in May, 1956, on *Domestic Heating in the United Kingdom.* The first volume was reviewed, as a report on the conference, in our Summer, 1956 issue. The new one contains three papers that were received too late for inclusion in the first volume, and the discussions on the five sessions.

The three papers are (i) The Distribution and Storage of Solid Fuel, by J. W. Stewart, (ii) Future Trends in Housing, by J. W. Forshaw, and (iii) Town Planning Aspects of Smokeless Zones, by Professor J. S. Allen.

The discussions on the sessions are of considerable interest, and those who wish to seek out the salient points in the vast amount of reading matter that these two volumes include will be well advised to read the reports of the Rapporteurs on each group of papers, together with the final, all-embracing report of the General Rapporteur, Dr. G. E. Foxwell. Crystallizing as it does the thoughts and trends of this large and representative conference, we should have liked to have been able to reprint this last contribution in its entirety.

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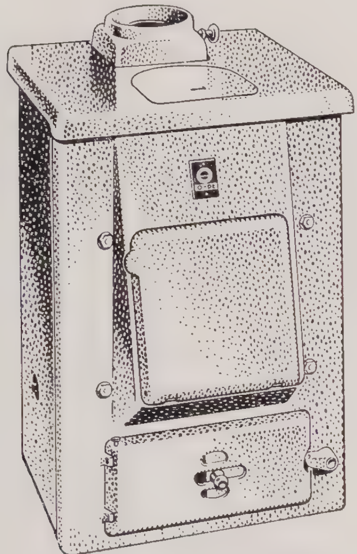

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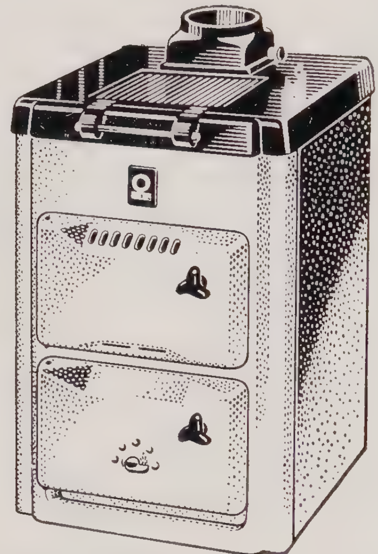

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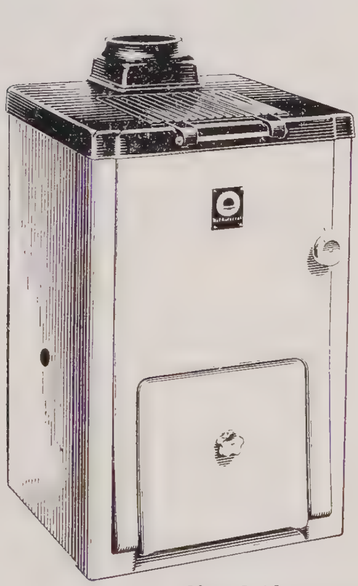
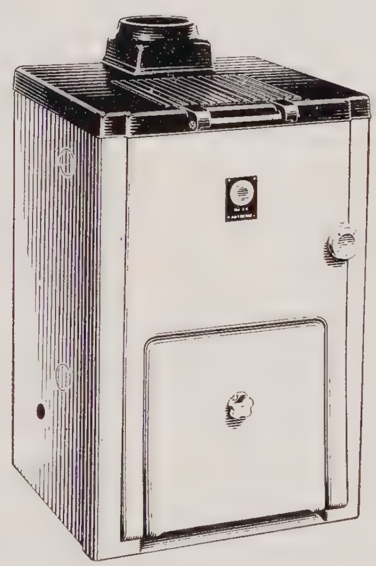


No. I 'Autocrat'



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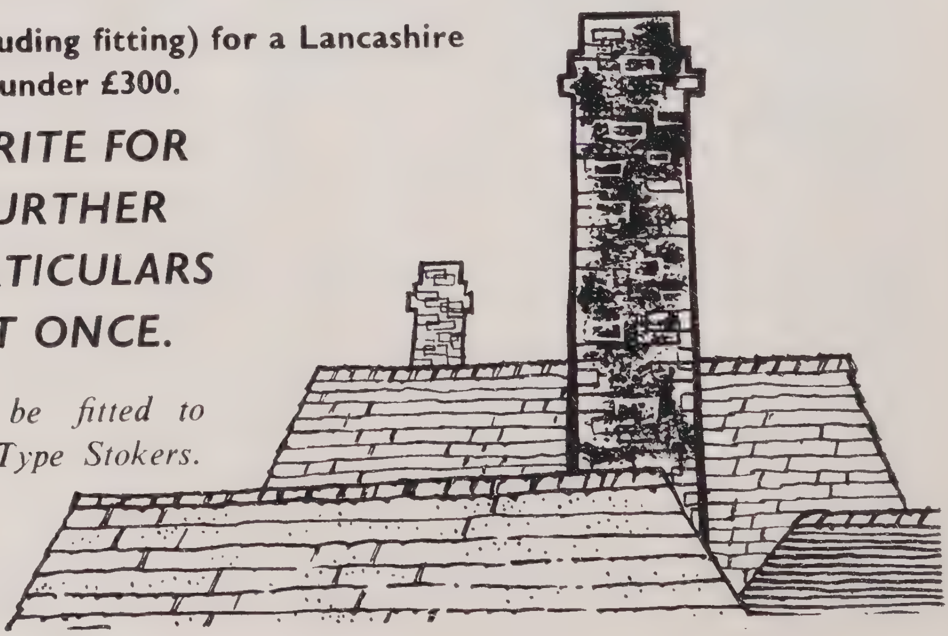

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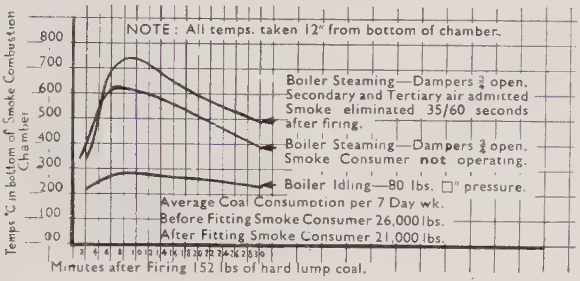

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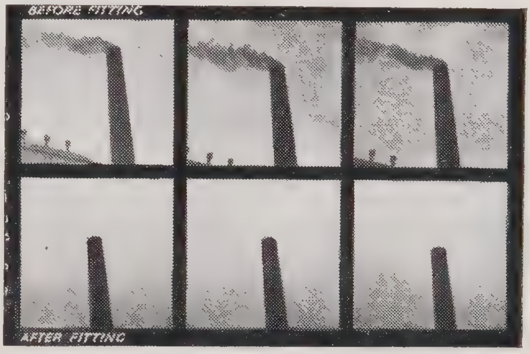

How effectively smoke is controlled is indicated by the unretouched photographs shown here. The 'before and after' shots relate to a hand fired natural draught Lancashire Boiler. The damper settings were identical. One cwt. of large nuts was fired to each grate and the photographs taken at the instant when fire doors were closed and at 15 second intervals. Conclusive evidence of the efficiency of the Godber Smoke Burner.

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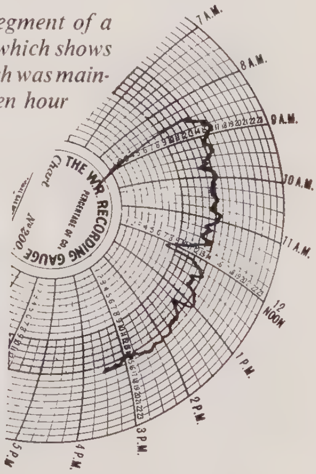

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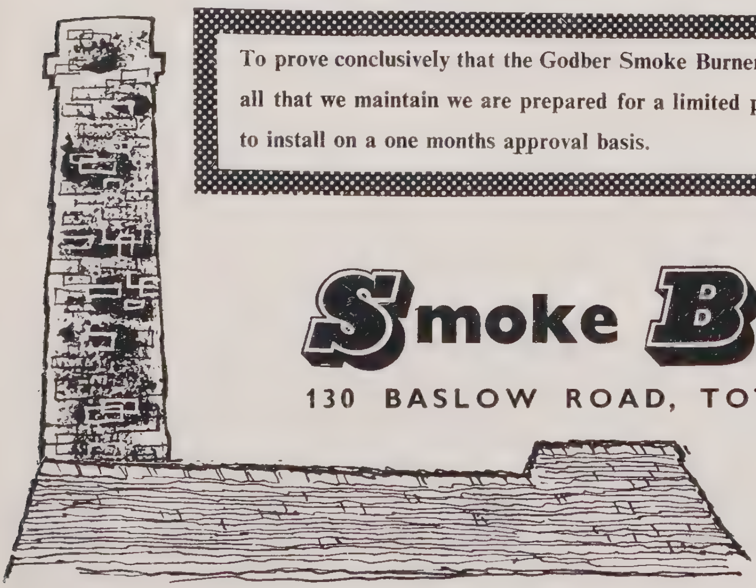

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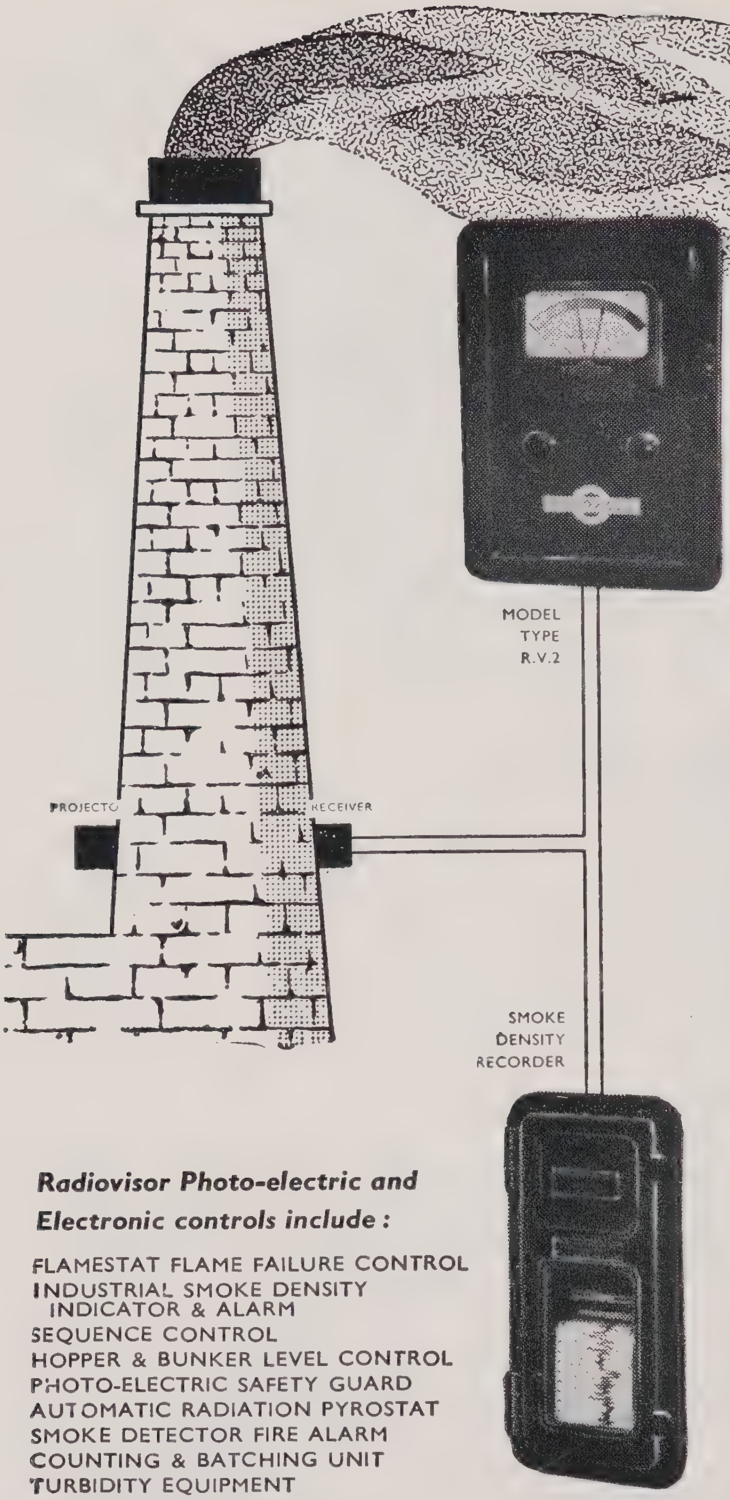

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The Clean Air Act ... 1s. 11d.
Memorandum on Smoke Control Areas ... 1s. 5d.
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Clean Air Act: Model Building Byelaw ... 4d.
Smoke Control Areas (Authorized Fuels) Regulations, 1956 ... 4d.

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Summary of the Clean Air Act ... 6d.; 4s. 6d. per 12; 30s. per 100

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SMOKELESS AIR

Vol XXVII. No. 102 Summer 1957

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SMOKELESS AIR is published quarterly by the National Smoke Abatement Society at Palace Chambers, Bridge St., London, S.W.1. Tel : TRAfalgar 6838-9 (Editorial and Advertising). Issued gratis to Members and Representatives of Members. Subscriptions rate for SMOKELESS AIR only, 4s. per annum, post-free.

Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

The Economics of Clean Air

ON another page we print a part of Sir Ewart Smith's introductory lecture to the recent conference on air pollution of the Institution of Mechanical Engineers. Sir Ewart, who is a Director of I.C.I. and has recently been elected to Fellowship of the Royal Society, deserves attention, and his analysis of the cost of carrying through the clean air programme, as proposed by the Beaver Committee, is of considerable interest, and should be the basis for much further discussion. As will be seen, he estimates the cost of clean air will be in the region of £600 millions. At first sight this seems a pretty considerable sum, but it is in fact encouraging that it should be so very moderate.

It has only to be remembered that the Beaver Committee's estimate of the annual cost of air pollution was £250, plus another £25 or £50 millions for the value of the fuel lost under smoke-producing conditions. Since then one of the members of the sub-committee that made the estimate has said that it was too conservative. We are not exaggerating, therefore, if we take the total annual cost of pollution at £300 millions. The present clean air programme aims to get rid of most of the smoke and grit, but not the polluting gases, so that it would not be true to say that its success would save the whole of this sum. Suppose we save only one-half, or £150 millions a year. This means that every four years we are wasting as much money (or wealth) through air pollution as we would spend in getting rid of it.

The expenditure of £600 millions —a once and for all charge—to save an annual wastage of £150 millions is clearly a sound economic proposition. On a smaller scale any prudent person would invest £60 to prevent an annual loss of £15. Indeed, it would be economically justifiable to spend up to three or four times as much.

It will, therefore, be good business for the nation to press on with the clean air programme, knowing that the cost will be only a fraction of the savings that will follow. Not to do so puts us in the position of a man who is steadily losing sixpences through a hole in his pocket because he shirks spending money on a needle and thread.

Why, then, is there still so much hesitation? Why is there not a more urgent public demand for the more vigorous action and investment that is needed? Why do we hear of local authorities having qualms about smoke control areas because of the cost involved? And why, as discussed below, do we find such vehement opposition —even if organized only by a few—to the first smoke control area order? There seem to be two main reasons, one following from the other.

The first is that, as Sir Hugh Beaver has pointed out from time to time, the expenditure on clean air does not appear in the same account book as the savings. The cost of prevention must be borne in definite, straightforward ways that are plain for all to see and perhaps to feel. The savings will come gradually, and even imperceptibly, in a host of different ways. It is only in the imaginary accounts of

the nation as a whole—those of the Government, the local authorities, and every firm, organization, family and individual—that we can find the true balance sheet.

The second reason is that in addition to the absence of a tidy balance sheet, there is still a profound unawareness among the greater part of the population—including the opinion-forming groups—of the economic case for clean air. There is a growing, but still vague, awareness that clean air would be a good thing in preventing smog, and so on, but as yet very little clear understanding of the hard facts of the case. The need for propaganda and education on a far bigger scale than anything yet possible, is imperative. It must be driven home, again and again, that at £600 millions clean air is a bargain.

On Liberty

WEST Bromwich, which gained the distinction of being first in the field with a smoke control area order—on which it was congratulated by the Minister—has met with some well-organized and ingeniously argued opposition. We understand that a Ministerial inquiry, as provided for in the Act, will be held to hear the objections. Because the same sort of controversy may arise elsewhere, it will be of general interest to examine the case that has been put forward by the objectors, who have published it in the form of a lengthy statement. (*West Bromwich Chronicle and Free Press*, 12th April, 1957).

Their first and most serious argument on principle is that which every social reform has to face: that smoke control is an attack on individual liberty. Says the statement: " The order attacks one of the fundamental liberties of the individual—the right to manage his domestic affairs according to his financial circumstances and inclinations."

Rarely has the fallacy been more obviously expressed. One of the most fundamental *rights* of the individual is to breathe natural air and to enjoy natural light. It is a gross interference with this right if his neighbour pollutes the air he has to breath and shrouds him from the light of day. No one denies the right of a person to do as he wishes in his own home, including the freedom to make smoke—provided he will keep it in his home. But when he pollutes the public atmosphere it ceases to be a domestic affair. The freedom of the individual to live in a healthy atmosphere is of greater importance than the freedom to use it as an aerial sewer to the detriment of others.

The next argument is a plea for doing nothing because one of these days everything may put itself right:

" Because of this arbitrary order, householders would be forced to choose makeshift appliances, where normally they would prefer more expensive and efficient types when, at a later date, they would be better able to afford them."

Then it is argued that the order disregards the worry and anxiety that the alterations may occasion; the possible difficulty that new appliances may not work efficiently; the problem of gas ignition if the gas pressure should fall too low; the price of fuel; that old bogey carbon monoxide, and many other debating points. It can be accepted that some of these arguments have some substance in them. No one would pretend that there will be no problems or difficulties in establishing smoke control areas and in securing the willing acceptance of new methods, especially by older people. This is perhaps the most cogent point raised, and it is clearly desirable to assist and guide those who by reason of age or infirmity may find it difficult to adjust themselves to new kinds of firegrate and new fuels. There may be a case here for giving them priority for fuels of the "Coalite"

and " Rexco " type, which would make the transition easier.

It is important that objections of this kind, absurd though some of them may sound, should not be impatiently brushed aside, but should be met with tact and consideration, or better still should be forestalled by much more extensive preparatory education and public relations work.

The New Constitution

THE Special General Meeting of the Society on 11th April, called to consider proposals for Incorporation, was attended by over a hundred members and representatives. The draft Memorandum and Articles of Association, and the Byelaws which will come into force with the new constitution, were passed without dissent, and the only amendment of consequence was one moved on behalf of the Executive Council. There were questions and some discussion of an explanatory nature on a number of points, which showed that a real interest was being taken in the proposals, and the proceedings did not become a mere formality of raising hands to the various resolutions. The meeting nevertheless took little more than a half hour to complete the essential business, after which there was some informal discussion on the Society and clean air activities generally.

The one amendment was to make a slight change in the proposed new name of the Society, so that it will become " The National Society for Clean Air ". This, it was felt by the Executive, and agreed to by the meeting, was grammatically better than National Clean Air Society.

The Memorandum and Articles of Association have now been submitted to the Board of Trade for their approval and permission to dispense with the use of the word " Limited " in the title. The new name cannot be assumed until this approval has been granted and the other registration formalities then completed. This usually takes some months, but it is hoped that the N.S.C.A. will come into being in time for the conference at Hastings in October.

New Clean Air Act Order

Liquid Fuel Appliances now Acceptable

The Model Building Byelaw, consequent upon Section 24 of the Clean Air Act, described in our last issue, requires that heating appliances in new buildings (other than larger installations covered by Section 3) shall be designed to burn gas, electricity, gas coke or anthracite. As pointed out in our note, this covers all the solid smokeless fuels, which will burn in any appliance suitable for coke or anthracite, but excludes oil.

Under Section 11 of the Act, which is concerned with smokeless appliances in smoke control areas, the Minister may make Orders exempting any fireplace from control in such areas if he is satisfied that it can be used without producing any substantial quantity of smoke when burning fuel other than authorized fuel. Any fireplace so exempted automatically becomes acceptable under the Act, for the purpose of the Model Building Byelaw.

A new Order, which came into force on 8th April, now includes oil-burning appliances among those which are named in the model building byelaw. This is done by exempting them from control in a smoke control area, and the order is therfore called the Smoke Control Areas (Exempted Fireplaces) Order, 1957.

The circular (27/57) issued with the Order points out that it will now be permissible under the new building byelaw to install in new buildings appliances of a type described in the present Order, i.e., fireplaces specially designed or adapted for combustion of liquid fuel.

The model building byelaw has also been modified directly by substituting the word " coke " for the words " gas coke " in sub-paragraph (*c*) of paragraph (1).

The new Order also gives an interpretation of " fireplace ", which it is stated includes " any furnace, grate or stove, whether open or closed ".

The circular gives some guidance to local authorities on the solid fuel appliances acceptable under the building byelaw. It may be helpful to quote this in full:

" A number of local authorities have also requested guidance on the types of appliances for heating or cooking which are suitably designed for burning coke or anthracite. The Minister is advised that, in general, appliances contained in the list of Recommended Domestic Solid Fuel Appliances published jointly by the Coal Utilization Council and the Solid Smokeless Fuels Federation which is current at the time of application for byelaw approval, would comply with a building byelaw based on the model. It should be noted that this list covers only those appliances which have been submitted for official test and passed as capable of burning coke or anthracite efficiently. For that reason it may not be exhaustive for the purposes of the byelaw. If application is made for approval to an appliance which does not appear on the list the local authority may think it desirable to ask for evidence to support the claim that it satisfies the byelaw."

Concessionary Coal

The West Riding Clean Air Advisory Council, with a membership of 76 local authorities, ask us to announce that they wish to make contact with similar bodies in other areas to exchange views and take joint action, when appropriate, on matters concerning the implementation of the Clean Air Act, with particular reference to the problem of concessionary coal. The Secretaries of such bodies are invited to write to the Hon. Secretary, Dr. I. G. Davies, Public Health Department, 25 East Parade, Leeds, 1.

PUBLIC INQUIRY ON SCHEDULED PROCESSES

This issue went to press before the opening date of a Public Inquiry on representations made in connection with the Order or Orders the Minister of Housing and Local Government proposes to make under the Alkali &c. Works Act, 1906, as extended by Section 17 of the Clean Air Act, 1956, and the Public Health (Smoke Abatement) Act, 1926.

The Orders are for the purpose of extending the list of works that are scheduled under the Alkali Act so that such works will be under the control of the Alkali Inspectorate instead of the local authorities in respect of smoke, grit and dust emission. It will be recalled that Section 17 of the Clean Air Act gives the Minister power to extend the Alkali Works schedule to include processes which are deemed to be " difficult " so that the Alkali Act will have effect in relation to smoke, grit and dust from these processes as it has to fumes and noxious gases. This part of the Act, many will remember, was strongly opposed by the local authorities, but its inclusion was insisted upon by the Minister.

A list has been published of those making representations either for works (or processes) to be included, or excluded. The list of those asking for inclusion is very long and detailed, and with but two exceptions all the representations are being made by industrial associations or authorities and not individual firms. The works concerned (some of which consist of a number of different processes) are classified as follows:

- Metallurgical works
- Power stations
- Gas works
- Industrial Gas plants
- Coke works
- Pottery works
- Lime works
- Chemical works
- Recovery of non-ferrous metals
- British Transport Commission undertakings

In addition, it is sought to have ammonium compounds added to the list of noxious and offensive gases.

Local Authority Representations

The representations made by or on behalf of local authorities are of course counter to those made by industry, and are as follows:

(1) The list of works in the First Schedule of the Alkali Act, 1906, and of noxious or offensive gases in Section 27 of the Act, should not be extended. (Association of Municipal Corporations).

(2) The list of works in the First Schedule of the Alkali Act should not be extended to include the additional scheduled processes referred to in paragraph 100 of the report of the Committee on Air Pollution. (West Ham).

(3) The existing list of works scheduled under the Alkali Act should not be extended, in so far as an extension would affect the areas of local authorities who employ an adequate and efficient Inspectorate and have adequate technical and other resources. (Sheffield and District Clean Air Committee).

(4) The inclusion within the Alkali Act of metallurgical works referred to in Section 109(1) of the Public Health Act, 1936, should be strictly limited to the few works where special technical difficulties exist. (Willenhall U.D.C., supported by the West Midlands Urban District Councils Association).

We hope to give a report on the Inquiry in our next issue.

Prior Approval

The Administration of Section 3 of the Clean Air Act

THE Technical Committee of the Society has been studying the practical questions that are arising from prior approval applications under Section 3 of the Clean Air Act. It has submitted to the Ministry suggestions for a revised and extended "code" of requirements, which it believes would be preferable to the present Appendix in the Government's "Memorandum on Miscellaneous Provisions."

The present note, however, concerns not the code of requirements that applicants for prior approval may be asked to observe, but the method to be used by a local authority when requests for the approval of new fuel-burning plant are voluntarily submitted to it under Section 3. It will be recalled that the local authority must be notified of any intention to install new fuel-burning plant in other than domestic premises. Notification is obligatory, but the owner of the plant may, if he so wishes, submit the plans and specifications and ask for their approval. If he does so, and secures approval, he cannot subsequently be charged with installing plant that it not capable of being operated smokelessly when burning fuel of the type for which it was designed. It should be noted that in this section there are no qualifications about the colour of the smoke, the periods of time that may be allowed, or deferces that may be offered, as in Section 1. Any smoke, emitted at any time and for any time, from a new furnace, may lead to action under Section 3—unless the installation has been previously approved by the local authority. It is therefore to the advantage of the owner to seek prior approval, even though he is not bound to, and it is hoped that in practice local authorities will, when new installations are notified, point out its desirability.

Prior approval applications may thus become customary, and the question arises of how local authorities can best deal with them. The code given in the Government's Memorandum, or a more detailed version of this on the lines suggested by the Society's Technical Committee or other bodies, outlines the principal factors that must be taken into account and give guidance to those responsible for the installation. They are not, however, a detailed schedule of what must be done. If prior approval is requested it is necessary for the detailed plans and specifications to be examined to see that they conform to the code and that they give due weight to any special or unusual features. If they are not entirely satisfactory it will be desirable for the local authority to explain why and to make constructive suggestions.

An important new responsibility therefore falls on the local authorities, calling for much sound and up-to-date technical knowledge and appreciation. How best can this responsibility be organized and administered?

It is clear that the answer must vary according to circumstances. The problem for a large local authority with technically qualified inspectors, in a heavily industrialized area, is very different from that of a small authority with few industries and which need expect only very infrequent applications. It must be remembered, nevertheless, that really difficult cases may occur in even the most rural of areas.

The Technical Committee considered a report that has been drawn up by one of its members on the procedure that has been used by authorities working a prior approval clause under local Acts obtained before the Clean Air Act. They came to the conclusion that the best example to suggest for general application was the Advisory Panel that has assisted the

county borough of Bolton, and which has dealt successfuly with a considerable number of applications.

The Panel consists of a Consulting Engineer, a Combustion Engineer from a local firm, an Engineer from N.I.F.E.S., the Borough Architect, the Medical Officer of Health and the Chief Public Health Inspector. When an application is received by the department the particulars are sent out to the members of the panel and an early meeting is arranged to consider them. If the proposals cannot be approved at once the difficulties may be discussed with a representative of the firm and suggestions made for overcoming them. Only rarely do the difficulties continue and on no occasion has a complete deadlock—or final disapproval—occurred. So well-known and accepted is this procedure that only once in four years has a new plant been installed without prior approval being sought.

The Technical Committee consider this system to be admirable for a town where prior approval requests may be anticipated in numbers that justify such a panel. It is obvious, though, that if every local authority were to set up similar panels a shortage of consultants would soon become apparent, even though in many cases the panel would have to meet at infrequent intervals. There seems therefore to be a need for joint area or regional consultative panels to be set up, responsible to all the authorities in the area, and including permanent technical members and local authority members who would need to attend only when an application from their own district was being considered. A convenor would be required, but the organization of such panels would appear to be quite straightforward.

A further point that should be borne in mind is that the fuel technologist or combustion engineer member of the panel should be known to and accepted by local industry, or that there should also be a member directly representing local industry. This would do much to create confidence and to help to ensure that the panel's decisions were accepted without complaint. This is in fact one of the suggestions made in the Government's Memorandum on Miscellaneous Provisions, which in commenting on prior approval procedure states:

" Some local authorities with powers of prior approval under Local Acts have found it useful for this purpose to appoint advisory panels whose membership includes Consultants, leading local industrialists and a representative of N.I.F.E.S. This is a useful way of associating industrial firms with the work of the authority on clean air and may encourage other industrialists to submit plans for approval."

Victor W. Dale

We record our very good wishes to Victor W. Dale, Director of the British Electrical Development Association, and for many years their representative on the Executive Council of the Society, on his retirement after 38 years' service with the Association. Mr. Dale has always been keenly interested in the Society and its work, and has helped us on many occasions. A presentation, from his friends in the electrical industry, and others, in the form of a cheque made up from a large number of small subscriptions, was presented to Mr. Dale after the annual luncheon of E.D.A in London recently. The Society was glad to have the opportunity of being associated with this tribute to a very good friend.

Great Reik of Colis

According to an article in the *Chemist and Druggist*, one Dr. Gilbert Skene, mediciner at King's College, Aberdeen, wrote a treatise on the plague of 1585, and enumerated among the causes stink, corruption and filth, and " great reik of colis without winde to dispache the sam," which last is translated as great smoke from coal fires.

The Conference

The programme for the Hastings Conference in October is now complete. It is with pleasure that we are able to announce that at the opening session on the morning of Wednesday, 2nd October, the conference will be privileged to hear an address by the Minister of Power, the Rt. Hon. Lord Mills. As a distinguished industrialist who has already made his mark as Minister during a not-too-easy period, Lord Mills has many responsibilities, and it is an honour to the Society that he should have accepted our invitation to attend and speak.

This address will follow the official opening of the conference by the Worshipful the Mayor of Hastings, and the Presidential Address by Dr. Lessing.

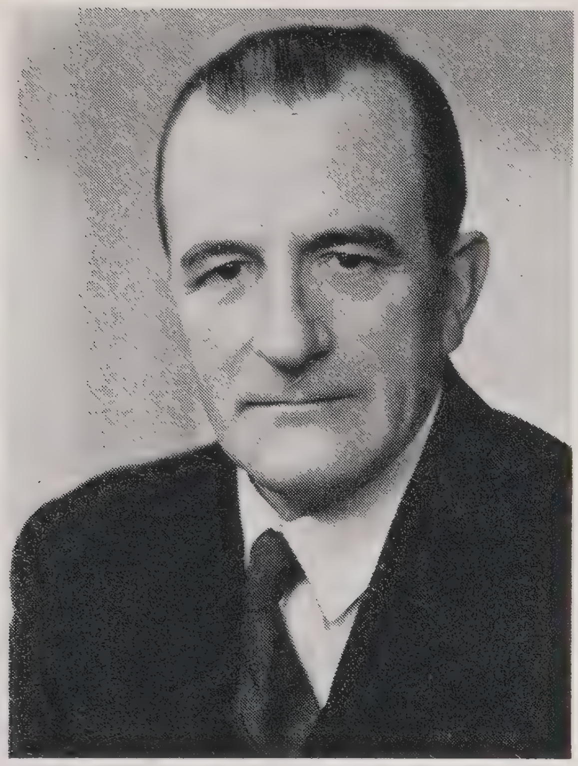
Alderman F. T. Hussey, J.P., will have been Mayor of Hastings for the fourth year in succession, while during the war he was deputy Mayor for a similar period. Such long services speak for themselves, and we can look forward with pleasure to meeting him both in the morning and at the Reception he is kindly giving to delegates on the Wednesday evening. Apart from his many municipal duties the Mayor leads a very busy business life and is Chairman of the East Sussex Growers, an association which has a membership of nearly 1,000.

Alderman F. T. Hussey, J.P.
Mayor of Hastings

On the Wednesday afternoon the subject for discussion is " Air Pollution from Road Vehicles ", with two authoritative papers. The technical means for the prevention of pollution from road vehicles, by design, maintenance and operation, will be given by Mr. H. E. Styles and Mr. A. T. Wilford of London Transport Executive, and the vexed question of the law relating to road vehicle pollution, and its enforcement, will be discussed in a paper by the Chief Constable of the Borough of Hastings, Mr. J. R. Archer-Burton, O.B.E.

On Thursday the conference will turn to the Clean Air Act and some of its implications. In the morning the working of the Act, in practice and principle, as it affects local government, will be examined in papers by Mr. Lindsay Taylor, Town Clerk of Tottenham, and Mr. Graham Don, who is both a Barrister-at-Law and Lecturer in Public Health at the London School of Hygiene and Tropical Medicine. There will also be a " Situation Report ", from the Society, on the supply and distribution of smokeless fuels in the light of smoke control area development.

On Thursday afternoon attention will be directed to " The Clean Air Act and Industry ", with papers by Dr. A. Macfarlane, Chief Executive of N.I.F.E.S., and Mr. L. A. W. Jenkins, an industrialist. The discussion will be opened by the President of the Institute of Fuel, Mr. J. R. Rylands. A good discussion can be anticipated, and the session should demonstrate



Lord Mills

once again the value of the Society's conferences in bringing together industrialists and the spokesmen of the local authorities.

As already announced, the Des Vœux Memorial Lecture on the Friday morning is to be by Sir Graham Sutton, F.R.S., Director of the Meteorological Office, on " Air Pollution and the Weather ". This, it can be promised, will be a fascinating lecture, which will be of subsequent value, for a long time to come, to the Society in its educational activities.

The lecture will be followed, as usual, by the formal Annual General Meeting of the Society and the consideration of any conference resolutions.

There is reasonable accommodation in Hastings for all, but nevertheless early reservations are recommended. A list of hotels and boarding houses is being sent to all delegates as they register. The headquarters hotel is the Queen's.

The White Rock Pavilion, Hastings, where the Conference will be held.

THE CLEAN AIR COUNCIL

The membership of the Clean Air Council was announced in the House of Commons on 7th May, 1957, by the Minister of Housing and Local Government. As required by the Clean Air Act the Minister is Chairman of the Council, and the Parliamentary Secretaries to the Ministers of Housing and Local Government and of Power, will be Vice-Chairmen.

The Society has addressed a letter to the Minister, welcoming the formation of the Council, hoping that we shall be given an opportunity to be kept in touch with the work of the Council and stating that " we shall be ready at any time to submit the Society's views on those phases of the implementation of the Clean Air Act on which, by its past record, it is best qualified to speak ".

The membership of the Council is as follows:

Mr. R. C. E. Austin, Town Clerk, St. Pancras; Mrs. A. L. Barker, alderman, Stoke-on-Trent; Sir Hugh Beaver, chairman, Arthur Guinness and Co. Ltd.; Dr. C. A. Bence, alderman, Cardiff; Mr. W. T. Bowen, alderman, Birmingham; Mr. J. A. Brown, councillor, Middlesbrough; Commander C. Buist, chairman, Low Temperature Coal Distillers Association of Great Britain Ltd.; Mrs. D. M. Charlton, chairman, Women's Advisory Council on Solid Fuel; Sir John Charrington, chairman, National Federation of Coke Distributors Association, and of the Chamber of Coal Traders; Mr. J. A. Connel, director of Technical Division, Unilever Ltd.; Mr. P. B. Dingle, Town Clerk, Manchester; Sir Josiah Eccles, deputy chairman, Central Electricity Authority.

Mr. C. S. Garland, president, National Union of Manufacturers; Lord Dudley Gordon, member of council of British Iron and Steel Federation; Mr. R. W. Husband, controller of engineering department, Beecham Group, Ltd.; Mr. H. W. H. Icough, chairman of the general purposes sub-committee, Metropolitan Boroughs Standing Joint Committee; Sir Henry Jones, deputy chairman, Gas Council; Mr. J. Latham, deputy chairman, National Coal Board; Mr. W. A. Macfarlane, chief executive of National Industrial Fuel Efficiency Service; Mr. R. S. MacTier, chairman of technical committee, Liverpool Steam Ship Owners' Association; Mr. F. V. Magness, vice-chairman, Willenhall Urban District Council.

Dr. Ll. Roberts, Medical Officer of Health, Sheffield; Mr. S. W. Saunders, managing director, Billingham division of I.C.I. Ltd.; Professor A. B. Semple, Medical Officer of Health, Liverpool; Mr. Jack Tanner, past president of T.U.C. General Council; Professor M. W. Thring, Professor of Fuel Technology and Chemical Engineering, Sheffield University; Mr. C. M. Vignoles, general manager, Shell-Mex and B.P. Ltd.; Mr. J. W. Watkins, member of the British Transport Commission; Mr. A. H. Wilson, managing director in charge of research and development, Courtaulds Ltd.

New Automatic Pollution Recorder

A new automatic air pollution recorder has been developed by Fleming Radio (Developments) Ltd., in collaboration with the Shirley Institute. The instrument has been developed for continuous monitoring at a price which enables it to be widely used by industrial and public health authorities. Samples may be taken every 24 hours, 8 hours or 1 hour, with a break of approximately 30 seconds between samples. A time mark is made on the filter paper strip at 24-hour intervals, enabling a ready check to be kept of day-to-day or hour-to-hour changes of condition.

An average quantity of 5·45 cubic feet of air is passed through the instrument per hour, using a Whatman No. 1 filter paper. This figure, and also those for periods of sampling, may be altered to suit individual requirements. The instrument is housed in a metal box and is designed to run for long periods unattended, although the samples may, at all times, be inspected without interfering with the running of the machine.

The Cost of Air Pollution and the Price of Improvement

Part of the Address to the Institution of Mechanical Engineers' Conference on Air Pollution, by

Sir Ewart Smith, M.A., F.R.S.

Vice-President, I.Mech.E.

ENGINEERS are concerned not only with technical problems but have, in addition, to consider costs. I should like therefore to give some estimate of the costs and savings which may be involved in achieving the level of amenity visualized by the Clean Air Act. Any such figures can be only the broadest approximations and may well be in error between the limits of plus or minus 25 per cent. However, they may give some idea of the effects on the national economy of the action which is contemplated.

The Beaver Committee estimated that the direct costs of pollution are some £250 million per annum, and this makes no allowance for readily avoidable loss due to incomplete combustion, which may be put at not less than £25 million per annum. Oxides of sulphur play a major part in the corrosion of structures and the rotting of fabrics, but it is at present not possible to visualize how the bulk of such pollutants can be eliminated. Taking this into account, and making some allowance in practical terms for residual pollution of other kinds, it would appear reasonable to assess the possible direct and indirect monetary savings at, say, £100–£150 million per annum.

When we turn to the capital costs of remedial measures, little published data exists; what there is, refers mostly to the cost of equipment proper and does not include the cost of installation, which may well bring the total up to two or three times the price of the equipment. In the case of large units which are straightforward, and which work continuously, such as the one quoted earlier in this paper, the addition or improvement of dedusting apparatus may amount to around £1 per ton of coal per annum. The relative cost will, however, rise rapidly with decreasing size and with the physical difficulties of installation where space is cramped; it will also increase if the plant only operates on one or two shifts. Taking all these aspects into consideration, and after making allowance for installations which already reach a tolerable standard, it would not be unreasonable to assume an overall average figure of between £2 and £4 per ton of coal per annum. If, then, we take the mean figure of £3 per ton of coal per annum, and apply it to the figures in Table 1, we arrive at a total of some £550 million. In addition, we have to allow for the costs of treating effluent arising from industrial operations other than straight combustion. At a guess, this might be put at between £50–£100 million, giving a total of, say, £625 million.

The following estimates of cost on a sectional basis provide an alternative method of arriving at the overall costs:

	Capital cost £ million
(1) Mechanical grates on small furnaces	
(*a*) It is estimated that there are about 40,000 hand-fired boilers. Taking into account size, and alternative conversion to coke or oil firing, the average cost may be taken as £1,000 per unit	40

Capital cost
£ million

(*b*) It is also assumed that some 2,000 process furnaces will need conversion at a cost of, say, £2,500 each, giving a total of 5

All this capital expenditure should give a good return through the resulting saving of fuel.

(2) Dust arrestors

We can exclude from this table provision of dust arrestors on very large plants such as power stations since they are mostly already installed.

All plants must in future, however, have some dust arrestors.

(*a*) It is estimated that medium-efficiency cyclones will become necessary in respect of a consumption of 20 million tons per year of coal by industry working one shift per day. The corresponding capital cost will be approximately 40

(*b*) In addition, much more expensive electrostatic precipitators may ultimately have to be installed in larger installations (burning about 30 million tons per year of coal) including boilers, metallurgical and cement plants, etc., on continuous shift. The corresponding cost will be approximately . . 60

(3) Higher chimneys

The estimated extra cost of the higher chimneys which will be required on existing and new plants for effluents from combustion and other processes . . 50

(4) Domestic premises

A recent estimate of the cost of installing smokeless heating and cooking appliances in smoke control areas is (Goulden 1956) 175

(5) Extra coke-making capacity

It is estimated in Appendix

Capital cost
£ million

XI of the Beaver Report, that the carbonizing capacity required above the normal increased production of the gas industry during the next 15 years (to correspond with (4) above) would be 10 million tons per year of coal. Sir Henry Jones estimates that the cost of large new carbonizing plant is £15 5s. 0d. per ton per year of coal carbonized. (Symposium on Coke 1955). This estimate includes the whole gas plant required to pump the gas into a gas grid, and is for production of coke suitable for improved open fire grates. The cost would, therefore, be 155

Total 525

It will be seen that the figure thus arrived at is in reasonable accord with the broader estimate of £625 million already made. This expenditure would be spent over a period of at least fifteen years. The rate of expenditure might, therefore, be taken as being in the region of £40 million per year, if evenly spread over the period which has been assumed. This is about 3 per cent. of the net annual expenditure on domestic fixed capital formation in 1955. Hence the cost of implementing the Clean Air Act, though burdensome, cannot be regarded as intolerable.

Conclusion

In this brief review, I have perhaps missed much that should have been said, and I may well have expressed wrong or misleading views. No doubt, however, the papers that follow will make good such omissions and errors. I am conscious, too, that in trying to give a balanced general picture, I have often stated the obvious, but to me one thing stands out—we must all treat pollution far more

seriously than hitherto, whether it be of the atmosphere, of the sea and the rivers, or the land itself. Much knowledge already exists on the means to achieve this aim, and more must be provided by research and development as time goes on. Most important of all, we as engineers must do our utmost to apply such knowledge as effectively as possible and far more than is now the case, to ensure that Great Britain is the clean and pleasant land we must wish it to be.

HOSPITAL SMOKE NUISANCE

On 15th March, when granting Nottingham Corporation a court order against Nottingham No. 1 Hospital Management Committee in respect of a serious smoke nuisance at Nottingham General Hospital, the chairman of Nottingham Guildhall magistrates, Mr. A. Turney, said: " This has been a shocking nuisance for a very long time." He added: " It seems something of an anomaly that a hospital should be guilty of air pollution. The fact that it has been so for such a long time does suggest a strange reluctance to get it put right as a matter of urgency which surely such a condition required. It is not for us to apportion blame, in fact we are feeling a certain amount of sympathy for the local hospital committee, but we are quite certain it is our duty to grant a nuisance order to operate in four months' time. We hope the granting of the order will actually help the hospital committee."

Mr. L. J. Thomas, for the defendants, told the Bench that while they bowed to the verdict, they wished to give notice of appeal. Solicitors argued for more than half an hour before the magistrates turned down a defence submission that the Hospital Management Committee was a Crown Office and therefore could not be prosecuted.

Mr. G. Guest, for the Corporation, then said: " For seven years there has been a serious nuisance caused by smoke at the Nottingham General Hospital. The Corporation has made every effort it possibly could to abate this nuisance, but there is a curious indifference on the part of the hospital authorities to do anything about what has been for a long time a serious nuisance." An abatement notice had been served on the committee in July, 1955, when the nuisance was caused by the use of steam-raising furnaces at the hospital. In March, 1957, the same equipment is still being used," said Mr. Guest. The Corporation's application was for a nuisance order requiring the hospital to abate the nuisance.

" The smoke inspection officer of Nottingham Corporation has paid 68 official visits to the hospital regarding this matter," said Mr. Guest. Mr. Guest called two residents of The Park, Nottingham, as witnesses for the Corporation.

Mr. Vincent Wales, smoke inspection officer, said that on a number of occasions he had seen black smoke issuing from the hospital chimney. A statutory notice for the abatement of the nuisance had been served on the hospital on 3rd August, 1950. Two more notices followed—in April, 1954, and July, 1955—and on each occasion these followed his observations of smoke nuisances.

For the defence, Mr. H. M. Stanley, secretary to the Management Committee, said the main difficulty in dealing with the nuisance had been one of finance. He said it was hoped that a second new boiler would be in operation in August. Cross-examined by Mr. Guest, he said the committee had no control over the expenditure on plant. " You have control of the management. Do you agree that a serious nuisance has been committed for a very long time? "—I do.

Walter Charles Jeffries, the regional engineer to the hospital board, said a second boiler was ordered and he was told there would be a delivery delay of two years. This had now been reduced as a result of pressure by the hospital authorities and it was hoped that it would be delivered by the end of next month.

The Boiler Operator's Certificate

Seeking to develop further the training of boiler operators as one of the most important means for reducing industrial smoke, the Society in the early 1930's took the lead in asking the City and Guilds of London Institute to hold examinations and issue certificates for Boiler House Practice. The Institute was interested, and an Advisory Committee was set up in 1933, on which the Society has been represented to the present day. The Boiler House Practice examination is moderately advanced, and a few years ago the Society proposed that there should be what it called a " national certificate " to take the place of a number of local certificates, and which would be of a simpler standard which every man on the firing floor would be able to take. The proposal eventually came into being as the Boiler Operator's Certificate of the City and Guilds. At the first examination in 1953, 125 men sat for it. In 1956 the number had risen to nearly 2,000.

There is no doubt that the Certificate has proved its value, and the time has now come—with the Clean Air Act making skilled boiler control more important than ever—for it to be publicized and made still more popular. Only the fringe of the job to be done has so far been tackled.

Towards this end the Institute has just published a most attractively produced booklet of 16 pages, plus four pages of photographs, describing the Boiler Operator's Certificate. It opens with a foreword by the Chairman of the Institute's Advisory Committee on Boiler House Practice, Mr. Sydney Duguid (who needs no introduction in this journal). He writes:

" This examination has undoubtedly struck the imagination of stokers and their employers who have encouraged them. It is also drawing attention to the skill required for efficient boiler operation and thereby raising the status of the stoker. It is hoped that the enthusiasm shown may inspire men already occupying higher positions in the boiler house also to take a course of study and sit for the examination appropriate to their grade."

The introductory section of the booklet explains that:

" The examination has been designed for the stoker, fireman and boiler operator working with boilers producing 1,000 lb of steam per hour or upwards. It is *not* designed to find out if he is a university-trained combustion engineer, but he *is* expected to know both the " how " and the " why " of running his plant properly. Possession of the certificate therefore shows that the holder can operate his plant efficiently, economically, safely and intelligently."

The booklet continues by giving the essential information about the examination, courses of study that may be taken, and the syllabus itself. It is hoped that it will find its way to all those employers and employees who ought to be interested, and to all the local authority members and officers who can actively encourage the holding of courses in their areas.

Copies of the booklet may be obtained, without charge, on application to the City and Guilds of London Institute at Gresham College, Basinghall Street, London, E.C.2.

A poll among residents who attended a " Foul Air " exhibition organized by the council of Bilston, showed that of 116 voters, 113 wanted their homes included in smokeless zones.

The National Association for the Prevention of Tuberculosis (Tavistock House North, Tavistock Square, London, W.C.1) have published the proceedings of a symposium held in December last on Chronic Bronchitis (pp. 44, 6*s*.). It includes ten short papers, including one by Dr. P. J. Lawther on bronchitis and air pollution.

LOCAL AUTHORITY NEWS

Local Authorities are invited to send us information for inclusion in this feature

Acton

Acton is to adopt the byelaw making compulsory the installation of appliances capable of burning smokeless fuel, in any new dwellings. The Chairman of the Planning Committee told the Council on 23rd April 1957 that all appliances in its own new flats were of the smokeless type.

Ashton-under-Lyne

Representatives of the Housing and Health Committees have met and decided that if practicable a smoke control area should be created within twelve months. The joint committee envisage this as a pilot scheme which will be gradually extended until the area covers the whole of the borough. In addition, the Housing Committee has decided that provided sufficient quantities of smokeless fuel are available, its use will be made a condition of tenancy on the Neal Avenue housing estate and on any future housing estate to be built by the council.

Banstead

The Town Planning Committee has recommended to the Council that a draft byelaw should be submitted to the Ministry for approval prior to the formal adoption and making of the byelaw by the Council.

Bermondsey

The Council is ready to confer with other boroughs about a common policy aimed at the gradual outward extension of the smokeless area in London from the City zone.

Bexley

The Council is considering establishing a smoke control area in the town, comprising one of its new housing estates. It is also adopting the byelaw governing the installation of smokeless fuel appliances.

Bilston

Two of Bilston's largest housing estates—Stowlawn and Bradley-lane—will become the town's first smokeless zones, the Mayor, Councillor W. H. Sandland, said on 11th April, 1957.

Birkenhead

The General Purposes Committee of Birkenhead Town Council are to consider a resolution of a special meeting of the Health Committee that preliminary steps be taken to allow the Corporation's housing estate at Woodchurch to be declared a smoke control area. This will be the first part of a long-term policy to create larger smoke-controlled areas in due course.

Blackpool

The Town Council has resolved that immediate action be taken towards the declaration of smoke control areas.

Bradford

The Council have given instructions for a scheme to be prepared under which certain further parts of the city will be designated smoke control areas.

Brentwood

The Council has adopted a minute of its Town Planning Committee recommending the introduction of a byelaw governing the installation of smokeless fuel appliances.

Brighouse

The Medical Officer of Health has suggested that the estate at Field Lane be made smokeless by means of a tenancy agreement.

Brighton

Brighton's Medical Officer of Health, Dr. W. S. Parker, will shortly report to the Council as to the need for establishing smoke control areas in the borough.

Bromley

The Council's draft byelaw concerning the installation of smokeless fuel appliances, has been accepted by the Ministry of Housing and Local Government.

Burnley

The proposed establishment of smoke control areas in Burnley was welcomed by most members of the Council at their meeting on 3rd April, 1957. Members heard favourable reports of a visit by a party of Housing and Health Committee members to smokeless housing estates at Bradford.

Camberwell

A start has been made on surveying thousands of houses and other buildings in Dulwich as a preliminary to declaring Camberwell's first smoke control area.

Chislehurst and Sidcup

The Urban Council has suggested a meeting at officer level to discuss the question of smoke control areas between nearby local authorities. It will serve as a preliminary to a later meeting of the authorities themselves. Representatives from Woolwich, Lewisham, Bexley, Bromley and Dartford Borough Councils, Orpington Urban Council and Dartford Rural Council have also been invited.

Croydon

A proposal by the Health Committee to establish a smoke control area in Waddon was carried at a meeting of Croydon Council on 25th March, 1957. The Council has also appointed a Clean Air Sub-Committee, and a Public Health Inspector has been seconded for special duties under the Act.

Doncaster

The Council is to adopt the byelaw governing the installation of smokeless fuel appliances in new buildings. A Sub-committee to consider defining a particular part of the town as a smoke control area, has been appointed by the Council.

Edinburgh

The Medical Officer of Health, Dr. H. E. Seiler, and the Chief Sanitary Inspector have been asked to report further on the possibility of establishing a smoke control area in the centre of the city.

Exeter

The City Council have declared three smokeless estates by clauses in tenancy agreements. They are Beacon Lane; Dunsford Hill-Brown's Nursery; and Howells and Heyword.

Gillingham

The byelaw governing the installation of smokeless appliances in new dwellings has been adopted by the Council, subject to approval by the Minister.

Halifax

The Town Council has approved the adoption of the model byelaw governing the installation of smokeless appliances.

Hayes (Middlesex)

The Council has approved in principle the establishment of smoke control areas.

High Wycombe

The Town Council is seeking approval of the byelaw relating to the installation of smokeless fuel appliances.

Holborn

The Public Health Committee has again considered the proposed voluntary smoke control area in Lincoln's Inn Fields and the extension of this area to include Lincoln's Inn. At the same time the Committee is considering the implications of the Clean Air Act with special reference to compulsory smoke control areas and will report to the Council at a later date. However, the Committee are unanimously of the opinion that at this stage the Council should declare its intention that the whole of the borough should become a smoke control area at some future date. At its meeting on 24th April, 1957, the Council agreed in principle with the Committee's opinion.

Kirkcaldy

Mr. J. Page, Chief Public Health Inspector, has suggested to the Council that the Links area be declared a smoke control area. A high proportion of the houses there will have under-floor

heating. Mr. Page thinks that the other houses being built in the area could be fitted with coke-burning grates. The proposal was before the Council on 8th April, 1957, when it was remitted to a joint meeting of the Health and Housing Sub-Committees, to investigate the question of smoke control areas as affecting the whole town, giving special consideration to the proposed area in the Links.

Lambeth

Lambeth is likely to be the first borough council in London to take advantage of the Clean Air Act to create a smoke control area. The Minister is to be asked by the Council to approve an area in the centre of the borough, south of the Oval cricket ground.

Leeds

The new estate at Roman Avenue, Roundhay, is smokeless by a clause in the tenancy agreement.

Leicester

A report with regard to smoke control areas was made to the Health Committee by the Chief Public Health Inspector on 14th January, 1957. He suggested that an area be created in the city centre.

Lewisham

Lewisham Council may set up three smoke control areas at Ladywell, Honor Oak and Southend Village, during the next year.

Leyton (Essex)

An invitation from Leyton Council to a conference to consider the Clean Air Act, has been accepted by Walthamstow and Wanstead-Woodford councils.

London (County)

Details of a plan to turn the whole of the 117 square miles of the County into a smoke control area were published on 8th March by the Metropolitan Boroughs Standing Joint Committee. Immediate consideration should be given to the creation of smoke control areas in boroughs adjoining the City, i.e. Finsbury, Holborn, Shoreditch, Stepney, Westminster, Bermondsey and Southwark. This area could be extended outwards by linking up areas created by outer boroughs, until the boundary of the County is reached.

Longbenton (Northumberland)

The Urban District Council has passed a recommendation of the Health Committee, aimed at establishing a smoke control area in the Benton Ward.

Longridge (Lancs.)

The Urban District Council has approved a recommendation of the Health Committee that the district be divided into zones from which a smoke control area programme could be prepared.

Mansfield

The Council, at a meeting on 30th April, 1957, passed a recommendation of the Health Committee that land near Old Newark Road which is scheduled for a new housing estate, should be included in a controlled zone.

Newcastle upon Tyne

The six investigators mentioned in our last issue were due to begin their survey of Newcastle's proposed smoke control area on 1st May, 1957.

Nottingham

Initiating action leading to some parts around the city centre being designated as smoke control areas will soon be in operation, according to the Medical Officer of Health's report for 1956.

Oxford

The formalities connected with a smoke control area in central Oxford—to which the City Council gave approval in March—are not likely to be completed before June next year.

Preston

The Smokeless Zone Order (Central Area No. 2) has been confirmed and will come into operation on 1st November, 1957.

Rochdale

At Rochdale Borough Magistrates Court on 29th March, 1957, John Parker, licensee of the Central Hotel,

Rochdale, was summoned for allowing smoke to be emitted from his premises (within the smokeless zone). The Chairman, (Col. J. B. Gartside) said that as this was the first case of its kind only a nominal fine would be imposed, and the defendant was fined £2.

Romily (Cheshire)

The Council is adopting the byelaw concerning the installation of smokeless appliances in new dwellings.

St. Pancras

On 1st May, 1957 the Council were given details of the first proposed smoke control area in the borough. The Medical Officer of Health, Dr. Dennis Geffen, will conduct a preliminary survey of the zone within the next few weeks.

Sale (Cheshire)

An application is before the Minister to adopt the byelaw prohibiting the building of dwellings without smokeless fuel appliances.

Salford

Salford Council approved a motion on 6th March, 1957, making it a condition of tenancy in all post-war corporation houses that only smokeless fuel be burned. This will also apply to all houses built in future. A motion was also approved authorising the adoption of the model byelaw governing the installation of smokeless fuel appliances in new dwellings.

Stockport

Within two years it is hoped to have established a smoke control area in Stockport town centre. The Council have approved in principle, a Health Committee proposal for the area, in which there are about 950 properties. Surveys for the area are being made and it is expected to cover about 70 acres.

Stretford (Lancs.)

Stretford Council are to adopt the byelaw concerned with smokeless fuel appliances in new dwellings.

Wakefield

The byelaw concerned with the installation of smokeless fuel appliances in new dwellings has been adopted by the Council.

Warwick

Percy Estate is to be smokeless by tenancy agreement. It will contain approximately 1,200 dwellings and is expected to be completed in 7–8 years.

Wembley

The Council's draft byelaw relating to smokeless fuel appliances in new dwellings has been provisionally approved by the Minister of Housing.

West Bromwich

Approved smokeless fuel appliances suitable for household use were on view to the public at a demonstration house equipped by the Corporation.

A deputation of householders protesting against the town's first smoke control area did not persuade the General Purposes Committee to change their minds. A report presented to the Council on 1st May, 1957, stated: " After full and careful consideration of the arguments put forward by the deputation, the committee reaffirm their attitude that the Council should take all possible steps to obtain the Minister's confirmation of the order." The Council decided to proceed in taking all possible steps to obtain Ministry confirmation. The residents will have a further opportunity to put their case, at a local inquiry to be held on 28th May.

West Ham

The Council is to adopt the byelaw concerning the installation of smokeless fuel appliances in new buildings.

Willenhall

Willenhall Urban Council has applied to the Ministry of Housing for permission to set up a smoke control area covering 419 houses at New Invention.

Woolwich

On 3rd April, 1957, the Council decided to ask the Minister to approve three smoke control areas, in Abbey Wood, Eltham and Woolwich proper.

Wrexham

Borough and Rural District Councils are considering joint action on their schemes for smoke control areas.

Dr. G. E. FOXWELL

It is with deep regret that we record the death, on 26th April, of Geoffrey Edwin Foxwell. After a serious illness, from which he appeared to be making a steady recovery, he died suddenly at his home in Ashtead, Surrey. Aged 64, he leaves a widow, two sons and two daughters, to whom our sympathy is extended.

Geoffrey Foxwell was a Doctor of Science and one of the best-known and respected of fuel technologists and technical writers and speakers. He did fine work during the war as Technical Adviser to the Ministry of Fuel and Power and in editing (and largely writing) the volume "The Efficient Use of Fuel". He was a contributor for many years to *The Gas World* and editor of the monthly *Coke and Gas*. He well deserved his appointment in 1955 to Companionship of the Order of the British Empire.

Dr. Foxwell evoked the admiration of all who knew him for the enormous amount of work, always of the highest quality, that he could accomplish, and the wide range of his interests, stretching far beyond the field of fuel, that he was always ready to discuss. A Presidential Address to the Institute of Fuel, broad, erudite and yet human, was a masterly piece of work. His interest and understanding of the problem of air pollution rightfully gave him a place on the Beaver Committee, and his analysis of the smokeless fuels problem in the Committee's report has perhaps been referred to and discussed more than any other one part of that report.

He was a fairly new member of the Society's Executive Council, where he represented the Institute of Fuel, but his interest in the Society, and his helpful advice on many occasions, goes back nearly thirty years. He was one of the speakers at a symposium on solid smokeless fuels arranged by the Society in 1934, and an article on post-war prospects of smokeless fuel development, which appeared in *Smokeless Air* in 1942, of all years, led to him being called upon by others to elaborate and extend his ideas in a way that greatly influenced thought on the problem. By his writings and his numerous discussions at meetings Dr. Foxwell helped to develop present-day policies on fuel matters perhaps more than any other one individual. Not always without controversy, it is true, but then he undoubtedly sought at times to provoke argument and fresh thinking, and he had a keen sense of humour and wit that made him delight to do so.

One is left a little baffled in attempting to pick out, in a few words, the outstanding impression, as a personality, that he leaves with one. His friendly, unassuming response on meeting or in conversation, the keenness of his mind, or the warm chuckle or laugh with which he could so readily blow away pretentious and confused ideas? Or just his uncommon dependability? Or the respect one felt on reading his writings or hearing him analyse and crystallize some long and many-sided debate? He was a man of notable parts, and his early passing is a real and serious loss, not only to his family and friends, but to the many bodies which, like our own, he did so much to help.

Air Pollution and the Public Health

Harben Lectures by Professor Philip Drinker.

A SERIES of three Harben Lectures, of the Royal Institute of Public Health and Hygiene were held in London on 13th, 14th and 15th May, 1957, under the general title of " Air Pollution and the Public Health" The author was Professor Philip Drinker, B.S., Chem.E., D.Sc., LL.D., Professor of Industrial Hygiene at the School of Public Health, Harvard University, and well known for his studies of air pollution problems.

In his first lecture Professor Drinker discussed air pollution as a problem of population pressure and compared conditions in Great Britain and various parts of the United States. The steady increase in the demand for energy in both nations had had a profound effect on fuel resources, which in turn affect pollution by discharge of man-made pollutants into the atmosphere. In the U.S. the energy demand was increasing at 3 per cent annually which is apportioned at about 32 per cent for heating (and cooling), 11 per cent for process heating, and 57 per cent for work heat (power stations, transport, etc.).

National pollution such as dust storms, fog, haze, volcanic eruptions were important in the general problem and could become serious if combined with prolonged stagnant conditions and temperature inversions. These had occurred now and then, as in the Meuse Valley of Belgium in December 1930, in Donora, Pennsylvania in late October 1948 and in London in December 1952. In all three episodes the air temperature was close to freezing, period of stagnation and temperature inversion was wholly natural and expected from time to time. In all three cases man-made effluents from chimneys were unquestionably the culprits but the actual amount of impurities thrown into the air during the fogs was probably no greater, perhaps even less, than was usual for that time of year. Had there not been prolonged stagnation (stable atmospheric conditions) lasting close to five days in each case the impurities would have been carried off as usual and made no special impression upon any one.

Britain alone had been measuring pollution systematically for some years before the 1952 disaster so was able to show for the first time in history the relationship between pollution and the heavy casualties it caused. If any good could be said to come from a disaster it was in the lesson it taught. The help which they in the U.S. had had from the admirable (and prompt) reports on the 1952 fog was inestimable. No other nation had had Britain's foresight and they hoped the lessons taught them would not have been in vain.

Los Angeles

The second lecture reviewed the special problem of Los Angeles, a community about as vast as London but entirely different from it climatically, topographically, and industrially. It was a huge, semi-tropical city which had grown from 300,000 in 1910 to about 6,000,000 today. It had been settled originally as an agricultural area devoted especially to growing of fruit, and then vegetables of all kinds. Beginning somewhere about 1930 it had become a major petroleum producer and refiner. To that had been added a chemical industry which had increased steadily since World War II.

The community relied almost en-

tirely on motor vehicles for transporting both goods and people. Of course there were vast railroad facilities and a man-made harbour, but Los Angeles was dedicated to automobile transportation for at least the next two decades.

The natural haze of the whole area, especially in summer and autumn, was traditional and had been there when the city had begun to grow. The entire district, extending at least 30 miles west of the coast line and close the same distance east towards the desert, had been shown to possess very unusual oxidative properties. During a bad Los Angeles smog, the oxidant value of the air, was some 10 to 20 times that found in any other large community studied. It was the happy hunting ground of automobile salesmen, with present new car registration reaching an incredible 3,000 per week. Yet their smog caused demonstrable damage to automobile tyres, and severe enough damage to vegetation to interfere with the raising of crops like spinach, endives, lettuce, and many fruits. In addition it had become more than a mere annoyance to people because it induced severe eye-smarting, it was most odorous, and it bothered many persons who may have moved there to enjoy what was unquestionably a very pleasant climate—but for the smog.

Britain's prolonged fogs were infrequent although undeniably serious from a public health standpoint. Los Angeles' troubles occur some 40–80 times a year, and only in warm weather. It was known what should be done about the serious episodes in Britain. Los Angeles had shown that theirs were unquestionably linked up with the exhaust gases from automobiles and probably from chimney discharges from power stations operating in the very best manner known today. The chief offender seemed to be nitrogen oxides, inevitable products of combustion both from motor vehicles and from industrial processes. It was doubtful if the community could reduce its motor vehicles but it seemed well within practical possibilities to control the concentration of nitrogen oxides emitted from vehicles and from chimneys. This posed a very attractive problem—admittedly difficult—to the chemist and one in which the possible financial awards were vast.

In the final lecture Professor Drinker discussed the cause and prevention of fluorosis in cattle, a disease which had been experienced in Britain and in the U.S. in somewhat different ways and from slightly different sources. It was wholly industrial in origin and the preventive measures required were known. The difficulty was that which was common to several industries, namely, the cleaning of vast volumes of air and combustion gases and the collection of impurities which were valueless. The cost of such cleaning, even if perfectly understood, could not be off-set by any reasonable returns on the investment. None the less the air cleaning had to be done or the effect upon vegetation and upon the cattle which normally graze in the area would be disastrous. He showed a picture of a cow with fluorosis so severe that she was kneeling on her forelegs while grazing. In such animals milk production was much reduced. In the U.S. such incidents had cost the offending manufacturers large sums to recompense farmers for loss in milk.

As damage to vegetation by pollutants had been such a serious problem in the U.S. Professor Drinker ended his last lecture with a series of coloured photographs of various forms of plant life damaged by gases from smelters, from chemical factories, and from automobiles. He concluded with graphs showing that, in modern cities such as Los Angeles, London and Paris, damage to plant life occurred when gasoline consumption, per square mile, exceeded a figure which had been reached about 1944 in Los Angeles, and was now being attained in London and Paris.

Clearly the problem was rendered more acute by population pressures and the multitude of activities which such pressures engendered.

Smoke Control Areas—Steam Generation Utilization—Training of Operatives

Four Papers at R.S.H. Meeting in Bolton

A SESSIONAL meeting of the Royal Society of Health at Bolton on 14th March, 1957, heard and discussed four papers on aspects of clean air policy. The authors were all members of Bolton's advisory committee for prior approval, to which references are made elsewhere in this issue. Mr. T. Williams, C.P.H.I. for Bolton discussed "Practical Experience in Smoke Control, with particular reference to the Clean Air Act", in the course of which he gave a most instructive account of the problems and procedure arising from the establishment of Bolton's smokeless zone. Mr. L. Shufflebotham, combustion engineer of Fine Spinners and Doublers Ltd. read a paper on "Efficient Steam Generation", in the course of which he suggested that improved fuel efficiency did not necessarily lead to smoke reduction. Mr. G. Gill, north western engineer to N.I.F.E.S. spoke on "Efficient Steam Generation" and showed how that the more efficient use of process steam can have considerable effect on atmospheric pollution. Finally, Mr. S. N. Duguid read a paper on "Education and the Clean Air Act", which had the sub-title "A Missed Opportunity."

We give some extracts of particular interest from each of these papers.

T. Williams

Mr. Williams gave a useful summary of the difficulties encountered in operating Bolton's first smokeless zone, in the central area of the town:

"It is interesting to consider the nature of complaints received during the first winter when the Order became operative. Out of 162 dwelling houses affected the following criticisms were made:

Anomalies caused by exemption of certain premises from zone ..	9
High cost of installation of appliances	17
Price of smokeless fuel	45
Increased amount of fuel consumed	17
Cost of gas for ignition purposes	8
Slow lighting of fires	18
Poor fires	16
Fumes from smokeless fuels ..	16
Lack of alternative cooking accommodation	3
Difficulty in heating oven ..	1
Unsatisfactory coke	5

(*a*) *Exemptions.* You will observe from the above that the exemption of certain factories within the zone gave rise to a suggestion of discrimination which emphasizes the care needed before excluding industrial premises from an Order when dwelling houses in close proximity are required to be smokeless.

(*b*) *Financial Hardship.* The cost of installation of appliances was, in fact, a hardship, especially in the case of old age pensioners, and in due course, although no other local authority had previously given financial assistance, the Bolton Council formulated a scheme which has been closely followed by the financial provisions incorporated in the Clean Air Act.

The complaints received relating to the price of smokeless fuel were felt, to a large extent, to be bound up with the use of unsatisfactory grates and consequent excessive use of fuel.

(*c*) *Quality of Coke.* The cost of gas used for ignition purposes was found, upon investigation, to have substance where the type of coke provided was the so-called "recovered" coke with a high moisture content, due to exposure to weather in the gas works during the summer months. Tests carried out by

the Health Department staff in cottage property using a special meter in an old pattern firegrate, which at this time many of the houses in the zone retained, gave the cost of gas ignition as approximately 4d. before a reasonable fire could be obtained. The time taken satisfactorily to ignite the fire in this experiment, using a portable gas poker, was as long as half an hour. The same circumstances were largely responsible for complaints about the time taken to secure ignition of fires.

Unsatisfactory coke was the subject of complaints in the earlier months. The Gas Board arranged for supplies of fuel to be placed in bags as it came from the retorts, so that householders in the zone, who in many cases buy coke in one-hundredweight lots, could be certain of dry coke of the right size and quality. No further complaints about quality of coke were subsequently received. Poor fires were alleged in some cases, but these were all resolved after demonstrations carried out by the inspectors.

(*d*) *Fumes from Coke.* Fumes were stated to be causing respiratory difficulties in several houses, and a medical certificate in support of an asthmatic condition was received in one case. The offer of alternative housing accommodation in this case was not accepted and, after a temporary allocation of low volatile steam coal, the occupier was gradually converted to use of smokeless fuel.

L. Shufflebotham

As the industrialist surveys the scene, he will probably view the Act as a regrettable necessity. He will usually have little idea as to how to set about meeting the requirements of the Act. If his firm is a large one, he may already have capable advisers, but, however capable they are, the uncertainties of the fuel position will compel them to use the words " provided ", " possibly ", " so far as practicable ", " if ", " subject to ", etc. When quotations, specifications and guarantees are put forward by the stoker manufacturers the same doubts will be apparent. Is it surprising that managements do not look forward with favour on the expenditure of large sums of money on plant when the entire effort can be destroyed by the stroke of a pen? The singles are changed to slack or the ash content increased say from 7 per cent to 17 per cent!

The manager can, however, by systematic improvements reduce the quantity of steam he uses in his works. He can, by the use of instruments, increase the efficiency of the boiler plant on any coal quality and, therefore, reduce the tonnage burned. It will be seen at once that a reduction in the amount of coal used means less coal to handle, less wear and tear on the coal handling plant or less manual labour, less ash and lower ash disposal costs, lower coal handling costs from the colliery to the works, and a reduction in the yard space required for storage.

The installation of instruments before that of new mechanical stokers ensures that only essential stoker equipment is installed. Where a number of shell type boilers are used, it may be found that one or more might be dispensed with, along with the capital costs of equipment on these boilers.

It will be seen that if the maximum reductions of smoke and grit emission are to be made, the problem will have to be dealt with in a far wider field than is covered by the Clean Air Act, and that if the industrialist is to obtain a return from his investment it can only be drawn from higher plant efficiency and the use of less fuel and labour. Expert advice is vital on any scheme, and it is not sufficient to have absorbed the contents of a text book on boiler-house practice. A considerable amount of practical " know how " is required in the design and operation of industrial plant.

Some idea of the savings possible was amply demonstrated at a Bolton cotton mill, when, over a twelve months' working period, there was a saving of over 1,151 tons of coal. The number of working Lancashire

boilers was reduced from three to two. The total saving at that time was £4,316 per annum on coal, and £500 on labour, the savings on ash removal, maintenance, etc., being ignored. The total cost of the installation was £11,444 and the percentage fuel saving was 23·8. We can safely assume that there was a reduction in the emission of sulphur dioxide to the extent of approximately 34½ tons over the twelve months. Assuming that previously the grit and dust emission was equivalent to 1 grain per cubic foot of flue gas, the reduction in grit and dust emission over the same twelve months would be approximately 33 tons.

This is indeed a move in the right direction, but this improvement is not apparent at the chimney top. In fact, the smoke emission is equal to that which existed before the plant was installed.

We are repeatedly given the impression that the cleaning of the air will be proportionate to the reduction of visual black smoke. Are we sure that we are on the right lines? Which will show the greater air improvement —the insistence on efficiency or the insistence on the clean chimney? Have we any proof of the extent of the emission of solid matter from any chimney in the two or three minutes that it may offend? Can we ignore the more factual results derived from higher efficiency? Can we as a nation afford to ignore it?

Whatever may be done in the name of the Clean Air Act should be basically right. We should not delude ourselves and give up one nuisance for another, unless it is basically sound to do so. We should not make more progress on paper than in fact. We must earnestly follow the cause of fuel efficiency, knowing that in the ultimate end it is in the interests of all to do so. In reducing the emission of dark smoke we must remember that this is not an end in itself. We must bear in mind that the battle for clean air begins at the coal face, and that all engaged in actively reducing the fuel consumption of the nation are working to the same end. On the other hand, shall we revert to the out-dated methods of the inspector eighty years ago with the notice and summons, and find that we have in seven years' time "clean" chimneys and still heavily polluted air? The choice is yours.

G. Gill

The elimination of peak demands and unnecessary steam load not only reduces the fuel consumption of the boiler plant, but in addition enables an improved thermal efficiency to be attained. As previously stated, the subject covers a very wide field, and each factory must be treated individually. A careful investigation into the heat usage in a works in order to prepare a heat balance, is the only satisfactory method of ensuring efficiency. Such an investigation will often bring to light many extravagant processes and practices enabling substantial savings to be obtained, which together will have a marked effect on smoke and grit emission from the boiler chimney.

Surprisingly, the Clean Air Act makes no reference to the importance of efficient steam utilization as an aid to smoke abatement. In view of the scope which exists for improving efficiency in this field, the omission is remarkable. Fuel efficiency will, of itself, result in a clean atmosphere, provided it is applied vigorously to cover all forms of fuel usage. Too great an emphasis on combustion efficiency will only partly achieve the objectives of clean air and reduced fuel consumption. There is little point in generating steam at a high thermal efficiency in a modern plant if the steam so generated is to be wasted and dispersed uselessly. Atmospheric pollution can be very noticeably reduced by preventing the unnecessary burning of fuel, thereby reducing the quantity of combustion products discharged into the atmosphere.

S. N. Duguid

This country intends to spend millions of pounds in order to produce thousands of scientists, but whilst

these Newtons, Watts and Einsteins are in embryo on the tree of knowledge, let us spare a few moments to consider the educational state of some of the men who, in the meantime, have to do the ordinary work of the world, and particularly those who keep the wheels of industry turning by burning fuel in furnaces.

Amongst the many omissions from the Clean Air Act, 1956, perhaps the one of greatest importance, and which has caused much disappointment, is that no reference is made to the necessity for training men who are in charge of, or actually operating, fuel-burning plant. Whilst recognizing the difficulties, it was anticipated that some clause might have been introduced which would at least indicate that, at some future date, a certificate of competence would be required by all such men.

Before the first world war the advocates of smoke abatement conceived the idea that less black smoke would be produced and less coal wasted if the stoker were trained to do his job. The outcome was the formation of a class in 1912 at the College of Technology, Manchester, under the title of "Stationary Steam Boilers" to distinguish it from a class entitled "Locomotive Management," already in existence. Engineers and stokers were invited to attend. This class is still running and is now known as Boiler House Practice, Intermediate (2nd year).

Similar classes were set up in other parts of the country but progress everywhere has been painfully slow. One of the difficulties is that in spite of all that has been said and written, stoking is still regarded as an unskilled job and anyone who is capable of standing up is eligible for such employment. Under such circumstances, why should a man trouble to fit himself for a job so lightly regarded? On the other hand, what chance has a boiler superintendent or chargehand of ensuring a clean chimney and fuel efficiency, if the men under him do not understand what he is talking about or have no idea of the purpose of the instruments with which the plant is fitted?

Tens of thousands of pounds are often spent on a new boiler plant and then it is handed over to unskilled men to run. A man firing two Lancashire boilers, can easily spend £10,000 per annum of the firm's money in the form of coal. Is it good business to allow an untrained man to handle such a sum? The truth is that the man actually engaged on the firing floor can make or mar any plant and therefore training is essential. This is the only civilized country where a certificate of competency is not required before a man is allowed to undertake such work.

Most engineers agree that only trained and certificated operatives should be employed in running steam-raising plant, but, unfortunately, no one at the necessary high level has thought fit to take action and consequently many of us are very sad that the opportunity was missed in this Act. A clause inserted in the Act recognizing the necessity for training would have been very welcome even though the appointed day on which it would come into force might have been left indefinite. It would have given much encouragement to those who have busied themselves for many years with the somewhat thankless task of promoting this type of education.

I am doubtful whether it will be possible to keep the density of smoke emission down to Ringelmann 2 or less, without the employment of skilled operators, and I think that the training of men in the running of boiler plant should be given high priority.

"One stoker irately remarked to the manager of a works and myself when the emission of dense black smoke from the chimney was pointed out to him, 'What the ——does it matter? Nobody lives up there'."—*Mr. A. Reynolds, Doncaster R.D. Inspector, in his annual report.*

Air Pollution in Europe and the U.S.A.

An O.E.E.C. Report

Air and Water Pollution: the Position in Europe and in the United States. Pp. 218. The European Productivity Agency of the Organization for European Economic Co-operation, Paris. U.K. Sales Agent: H.M.S.O. U.K. price, 18s. U.S. price, $3.

This volume is the report of two O.E.E.C. missions, one dealing with water, and the other with air pollution. The two missions were quite separate and their reports, although in the same volume, are also separate. They enjoy a common foreword and recommendations. Air and water pollution problems have a little, but very little, in common, and to attempt to make recommendations that will cover both has inevitably led to very broad generalizations. Thus on legislation it is said:

" The considerable differences between pollution problems make it somewhat difficult to fix standards that are applicable to all cases. All new legislation, or any modifications to existing legislation, should as far as possible take into account the actual situation, past experience and the findings of technical research so as to ensure that the measures introduced will be effective."

The air pollution mission was under the chairmanship of Mr. Carl L. E. Jensen, of Denmark. Other countries represented on it were Belgium, France, Germany, the Netherlands, Portugal and the U.K. The British representative was Mr. W. A. Damon.

Much of the report consists of short accounts of plants visited by the mission in the various countries visited. Much of this is of special technical interest, but it is not easy to draw any general conclusions. Only four of the numerous plants visited were in the U.K.—May and Baker Ltd., at Dagenham, the Shell Oil Refinery at Stanlow, Cheshire, and two synthetic fibre plants: Courtaulds Ltd., Preston, and British Enka Ltd., Aintree.

A section on the effects of air pollution, health and vegetation, is largely based on U.S. conditions, as is a chapter on research. The number of visits made by the mission to authorities, organizations and institutions, as well as to plants, in the U.S.A. is much larger than those made in Europe. The list of institutions visited in Europe does not, indeed, include any in the U.K. except the Water Research Station of the D.S.I.R. Surely they should have visited the Fuel Research Station, to name only one organization concerned with air pollution?

The most useful part of the report is the summary of legislation for the control of air pollution in the countries visited. The U.K. section here is equal in length to the others put together, largely because of the details it gives of the Alkali &c., Works Act and the legislation recommendations of the Beaver Report. Because the situation in the European countries visited will not be familiar to most of our readers it will perhaps be of interest to quote these paragraphs in full:

Belgium

A special provision—the " Règlement Général pour la Protection du Travail " prescribes in the case of calcining of minerals and extraction of zinc, the height of chimneys according to the concentration of SO_2 in the smoke, and the temperature of smoke. This regulation is also applicable to other industrial smoke containing SO_2.

Denmark

There are no special regulations controlling air pollution. Under the general legislation governing public health and welfare, it is unlawful for anybody to cause danger or nuisance to

persons, or damage to property by smoke, dust, obnoxious smells or noise. The Directorate of Health, which comes under the Ministry of the Interior and has separate commissions in the various local communities, can take action against infringements of these very elastic rules. A special law (renewed 1954) concerning the welfare, health and security of factory workers, is applied through labour inspection under the auspices of the Ministry of Labour and Social Affairs.

The Danish Academy of Technical Sciences has, in recent years, supported investigations into air pollution in towns and cities.

France

Included in regulations governing most industrial firms, is a clause prohibiting discharge into the atmosphere of dense smoke, vapour, soot, dust, or toxic or corrosive noxious gases liable to be detrimental to public health and safety, agricultural production, public monuments and scenic beauty. In addition, the Act of 20th April, 1932 deals particularly with the suppression of noxious industrial smoke.

These regulations, however, are not sufficiently explicit as to the degree of pollution which is considered harmful.

Only in the department of the Seine are there regulations in force which apply to users of furnaces burning coal, oil, or its derivatives. These regulations stipulate that:

During normal working, the density of the smoke must not exceed No. 1 of the Ringelmann scale; in the case of periodical stoking any density in excess of this figure must not last for more than 5 per cent. of normal firing time.

Combustion gases must not contain more than 1 per cent. by volume of carbon monoxide and 2 per cent. of sulphur dioxide. Gases issuing from chimneys must not contain more than 1·5 grammes of dust per cubic metre at 0° and 760 mm. of mercury, and the total quantity of dust must not exceed 300 kg. per hour.

The chimneys must be of sufficient height to ensure that gas and dust can be diluted or suspended in the atmosphere as ruled.

In view of the unsatisfactory results obtained, on a national scale, the Government has arranged for a study of the problem of air pollution to be made in the " Comité Consultatif des Établissements Classés," with a view to drawing up instructions (as in the case of water pollution) to help solve the problem as far as possible.

Germany

There is no law prohibiting air pollution or providing for any penalty. The law covering nuisances by industrial establishments dates in part from 1869, and both government authorities and industry are agreed that a review of existing legislation should not be delayed any longer. The Institute of Water, Soil and Air Hygiene is at present engaged on the preliminary work of establishing standards which may provide the basis for reform.

The Netherlands

The question of atmospheric pollution is more complicated. There is no special State institution specifically responsible for studying atmospheric pollution. The municipality cannot issue a permit without first consulting the regional Inspector of Works. If the Chief Inspector decides that there is a risk of polluting the atmosphere, he offers a remedy which can then be enforced by the municipality.

The municipality can also consult the Inspector of Public Health.

The main initiative regarding decisions by the municipality on measures to control air pollution by plants and factories rests with the Chief Inspector of Works.

All parties concerned can appeal to the Crown against a decision by the municipality; the Crown, on the advice of the Minister of Social Affairs and Public Health, makes the final decision. The Minister is advised by several experts, who include officials from the Inspection of Works.

(*Concluded, page 262*)

A Birmingham Clean Air Pioneer

The Influence of John Cadbury

by Maurice H. Bailey

The following article is an extract from a thesis submitted to the University of Birmingham on " The Contributions of Quakers to some Aspects of Local Government in Birmingham, 1828–1907." *It is not only a tribute to a determined industrialist ahead of his time, but an illuminating picture of the smoke problem as it existed a century ago in one of the new, rapidly-growing industrial cities.*

JOHN CADBURY'S major contribution to the work of the Commissioners was as a member of the Steam Engine Committee. By the Improvement Act of 1828 the Commissioners were given power to deal with the nuisance created by smoke emitted by steam engines. Clause LVI of the Act reads:

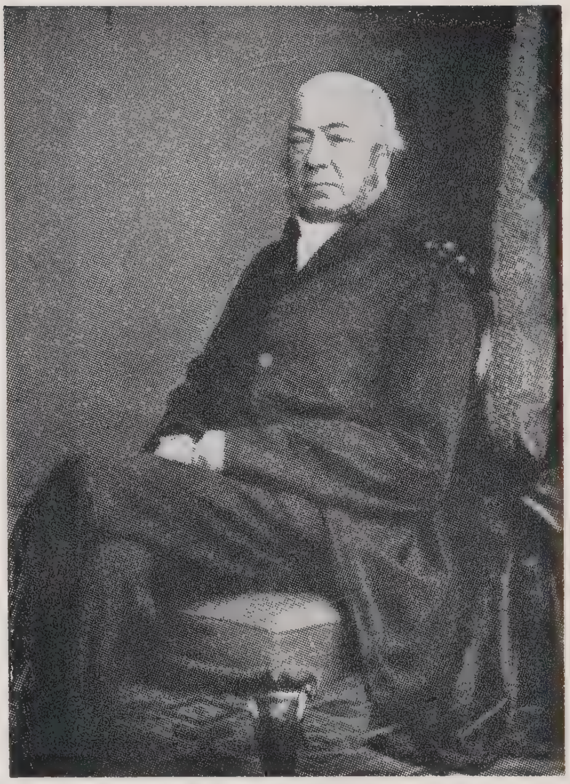
> " And be it further enacted, That the Owners or Occupiers of all Engines commonly called Steam Engines, which have been erected since the passing of the said recited Act, or which shall at any Time hereafter be erected, set up, or used in the said Parish of Birmingham, shall use the Mode or Method now adopted, or other equally efficacious, to consume and burn the Smoke arising therefrom, so as to prevent the same occasioning any Nuisance whatsoever; If any Person or Persons shall use any such Steam Engine without burning or consuming the Smoke upon the Principle aforesaid, they shall forfeit and pay for every such Neglect or Default Fifty pounds, to be recovered by Action of Debt or on the Case in any of His Majesty's Courts of Record at Westminster."

For some ten years the Commissioners made very little use of these powers. On two occasions—in 1831 and 1835—the attention of the Board was drawn to " the great and increasing Nuisance arising from several Steam Engines in various parts of the Town ". On both occasions a committee was set up to consider the matter, and on their advice it was decided to take action against some of the offending parties. On both occasions, however, the offenders gave assurances that they would take steps to abate the nuisance, and the actions against them were allowed to drop. Then, in 1839, the question was again raised, and a committee was appointed to " examine into any nuisances that might exist in the town, and take effectual steps for their removal." In the following three years this committee considered a number of complaints about chimneys in various parts of the town, and as a result of their intervention a few owners carried out improvements. But in general their efforts met with no success, and by 1842 the committee seem to have been of the opinion that nothing further could be done in the matter.

In 1843 John Cadbury was added to the Steam Engine Committee. Three years earlier, in 1840, he had been an offending proprietor, for the Board had received a complaint about the smoke emitted by his steam engine in Crooked Lane. But John Cadbury applied a successful remedy, which convinced him that there was no reason why the atmosphere should ever be polluted. He brought to the Steam Engine Committee a missionary zeal which soon changed the attitude of the other members. The next report made by the committee reveals a new approach to the problem, asserting " that the causes of the complaint so justly made of the great

Nuisance arising from the smoke of Engines may be effectually obviated not only without any sacrifice on the part of the Owners of Engines but with an actual saving in fuel. Under these circumstances the Committee submit to the Commissioners that it is their duty in accordance with the powers of the Act to require all Proprietors of Steam Engines to adopt means for consuming the smoke, and with a view to giving them an opportunity for so doing without legal proceedings the Committee recommend the Commissioners to direct their clerks to give notice that all owners of Steam Engines who shall not have applied an effectual process for the above purpose on or before the 1st day of January next will then be proceeded against without further notice." This recommendation was accepted by the Board.

John Cadbury's first important practical contribution towards dealing with this problem was to introduce into the town in 1843 "a far more efficacious and simple mode of consuming smoke than any hitherto invented," which was made available to the public free of expense. In May 1843 he said "that he received many communications with respect to the method of consuming smoke to which he had alluded at the last meeting of the Commissioners; numerous trials of the plan had taken place, the results of which had fully established the important fact that the consumption of smoke is easily attainable, and that, in addition to the slight expense attending the application of the apparatus, the consumption of coal is one-third less than under ordinary circumstances. The invention was made known by some of his friends in Lancashire, by whom it had been discovered, and who had found it to answer every purpose sought to be accomplished by the numerous plans of the same nature for which patents had been taken out. It was likewise so simple and so easily applied, that he had only received an intimation respecting it at nine in the morning, and it was in full operation in his own steam furnace at four o'clock in the afternoon of the same day."



John Cadbury

The First Inspector

In 1844, probably at the suggestion of John Cadbury, an inspector was appointed, whose duty it was "to perambulate every part of the town within the jurisdiction of the Commissioners, and inspect the Steam Engine Chimneys and report cases in which the Proprietors of them failed to suppress the Smoke Nuisance." This appointment marked an important change of policy. Hitherto the committee had only interfered in cases where a complaint had been lodged by a ratepayer. Now they planned to tackle the problem as a whole, and obtain evidence themselves against all offending parties.

In the following eight years much work was done to abate this troublesome nuisance. At Warwickshire Assizes in 1844 the Commissioners obtained a verdict against the owner of a Steam Engine in Snow Hill, who had to pay one penalty of £50 and the costs of the action. Again, in 1846, the Commissioners obtained a judgment against Messrs. Willoughby and

Gold of Lionel Street of £500, but they did not enforce it as the proprietors made considerable improvements. In other cases, however, no resort to legal proceedings was necessary, the owners being persuaded to adopt some means for consuming the smoke.

When the Inspector commenced his duties in 1844 there were 173 Steam Engine Chimneys within the limits laid down by the Act. Of these, at least 111 emitted dense black smoke from 16 to 35 minutes in each working hour, while the rest varied from 6 to 16 minutes per hour. By 1849 a considerable improvement had been effected. Of the 224 Steam Engines then in use in that part of the town within the limits of the Act, 17 emitted dense black smoke from 12 to 18 minutes in every hour, while a further 50, though greatly improved since first they came under inspection, were still indifferent, emitting black smoke for 6 to 16 minutes in each hour. The remainder only smoked for 2 to 6 minutes per hour.

In 1851 John Cadbury, who was then Chairman of the Steam Engine Committee, presented its last report. Out of the 279 chimneys under the jurisdiction of the Commissioners, 224 were fitted with apparatus which suppressed the nuisance, leaving only 55 which were discreditably bad. Unfortunately amongst the neglectful proprietors were a number of gentlemen holding official positions in the town, including one of the members for the borough, five magistrates, three members of the Town Council and one commissioner.

For nine years John Cadbury was a very active member of the Steam Engine Committee. For some years he was its chairman, and often presented its reports to the Board. By 1850 he could claim a thorough knowledge of every proprietor and of the history of every chimney in the town. Certainly he was responsible for reinvigorating the committee and changing its policy into one of aggressive warfare against the smoke nuisance, which resulted in the reduction of the number of bad chimneys from 176 to 55.

O.E.E.C. Report

—Concluded

Portugal

There are no special regulations providing against air pollution. However, the authorities under whose supervision this problem comes, may intervene by suggesting or enforcing action required to avoid the nuisance caused by pollution of this kind.

Decree 8332, of 17th August, 1922, Article 7, specifies:

> " Industrial chimneys must be higher by at least one metre than the highest point of the roof of any building situated within 50 metres radius, the centre of which is the chimney's axis."

Under a Ministerial order of 7th November, 1932, it was left to the discretion of visiting engineer inspectors to fix the height of a chimney so that fumes or smoke should not cause any inconvenience in the neighbourhood of the factory.

Sweden

There are no legal provisions regarding air pollution.

Any person suffering damage through air pollution can, however, institute a civil action against the person responsible, and may claim damages and the taking of measures against the pollution.

The effect of air pollution on health is the province of local health authorities who have powers to prohibit the carrying on of an industrial process if the pollution caused involves obvious inconvenience from the health point of view.

Committees have been set up to enquire into the need for more stringent rules against water and air pollution.

PEAT IN THE CLEAN AIR AGE

Its Value to Scotland

by Norrie Fraser, M.A., F.G.S.(Scot.)

Peat is a fuel as old as time, and certainly older in use than coal. Apart from the age-old peat stack beside the traditional lone sheiling, has peat a place as a fuel in the 20th century?

The answer here suggested is that peat has not only a place, but, as peat briquettes, a very useful place in this clean air age. If we take Scottish policy to meet the challenge of the Clean Air Act—largely the same as England's—we find that the authorities are up against the major difficulty of insufficient suitable smokeless fuels. Especially as the housewife still likes her family gathered round the immemorial open hearth.

In Scotland the supply of natural smokeless fuel is hopelessly inadequate. Of the manufactured smokeless fuels the Phurnacite type of fuel is also possible only in very limited quantities and is not suitable for open fires. The reactive low temperature cokes of the Coalite, Rexco variety, which can be burned in open fires, are also limited. The total quantity of such fuels available in Scotland is about 10,000 tons per annum, or $\frac{1}{4}$ of 1 per cent of the total domestic fuel consumption, according to Dr. Chamberlain of the National Coal Board. No great development is possible as the supply of suitable high grade coal is limited.

The authorities are, therefore, driven to look to the extended use of gas coke, of which 300,000 tons are already sold on the Scottish domestic market, representing 8 per cent of the total solid fuel consumption. The economics of the Cleanglow and Phurmistor types of open fire cokes depend on the greatly increased industrial and domestic use of gas. At the moment it is believed that 600,000 tons of gas coke per annum, or twice the present amount, could be made available.

In short, smokeless fuels in Scotland are either expensive, in short supply, or both. So that any useful addition to such fuels, until the nuclear age is fully with us, around A.D. 2,000, is very desirable.

Such a fuel, one believes, is peat briquettes. These are not new to Scotland, having been first manufactured nearly 40 years ago. Their manufacture was taken up seriously in the 1930s, when the Peco milled peat drying and briquetting method was developed at Lochar Moss near Dumfries. As we had no apparent fuel difficulties in those days, no large scale plant—which would have been such a blessing today—was built here. The Peco—made in Scotland—method for briquetting peat went, as too often, to the enterprising foreigner. Denmark, Sweden, Russia, Germany and Eire all developed peat briquettes on this method. The actual press is a modification of the Brown Coal press as used in Germany.

Peat contains on an anhydrous basis approximately 67 per cent volatile matter, made up of tars and gases. While thus not an inherently smokeless fuel like anthracite, it can be, according to Bord Na Mona, the Irish Peat Board, burned in properly designed appliances, stoves or fires, with absolutely clean combustion, except for a very short period during the lighting up. Since peat briquettes ignite much more quickly than coal these periods are short. Also, since peat briquettes contain 10–12 per cent moisture, much of the " smoke " is simply steam.

In addition, unlike many smokeless fuels whose noxious sulphur emission is high, peat has a very low sulphur content—less than $\frac{1}{2}$ per cent. The briquettes are completely clean to handle. The ash content is also low at approximately $3\frac{1}{2}$ per cent, and there

are no cinders. Present dimensions are $1\frac{1}{2}$ in. by $2\frac{1}{2}$ in. by $7\frac{1}{2}$ in., but these can be modified.

The only real disadvantage is the lower calorific value of peat, 8,000 B.Th.Us per lb. compared with 12,000 for coke and around 11,000 for semi-coke. Bord Na Mona figures give the current selling price of loose briquettes in Dublin at £5 14s. to £6 10s. per ton, which can be placed against the current Edinburgh prices of £7 6s. 5d. per ton for gas coke and £10 9s. 3d. for semi-coke. Labour costs in manufacturing peat briquettes in Scotland would be higher than in Eire but at worst peat briquettes would still be competitive with semi-coke; would be cheaper than imported American coal; and would solely perform a service to the nation in a dual as well as a fuel capacity. They would free thousands of acres of land from the wet blanket of peat, and make them available for forestry and agriculture.

Under the Department of Agriculture Survey of the Scottish bogs the whereabouts of suitable peat deposits are fully known. It is established that of the 1,000,000,000 tons of peat solids in Scotland, on the most modest estimate, 250,000,000 tons could be used to produce peat briquettes, at whatever yearly output is thought desirable. A plant to manufacture 60,000 tons of peat briquettes per annum, would cost something in the neighbourhood of £1,000,000. It is also possible to manufacture peat briquettes on a local scale—the soft or semi-briquette—in a small press. But these contain 20 per cent instead of 12 per cent water and are of less calorific value.

There is, therefore, a very strong case for a rapid development of Scottish peat to supplement existing " clean air " fuels. The housewife, bidding a reluctant farewell to the old-fashioned glory of the bituminous hearth, and not very happy about coke, would welcome the clean burning tang of peat, which gives people, not without a certain scientific justification, a feeling of physical well-being. The nation would benefit by the utilization of one more of our natural resources, of which the sum total is none too great, in these days of desperate foreign competition. The nation would benefit too from the reclaimed land, freed for food growing and timber production.

The peat areas are known. The process " made in Scotland," is known. The diversion of a few million pounds is alone required to provide thousands of tons of peat briquettes as a delectable " clean air " fuel.

OCCUPATIONAL HYGIENE CONFERENCE

The British Occupational Hygiene Society held a conference in London on 16th and 17th April on instruments for use in occupational hygiene, at which eight papers were read.

Dr. P. J. Lawther, of the Atmospheric Pollution Research Unit, spoke on " Analytical and clinical methods in the study of atmospheric pollution." In order to understand the harmful effects associated with dirty air it was necessary to study concurrently the character of the pollutants and the health of susceptible patients. Many complicated instruments were applied to each angle of the work, but, in the last analysis, it was the effect on the human being which mattered. Interpretation of this in terms of instrumental indices was so difficult that it had been found profitable to employ the human observer himself as a recording instrument. How this had been accomplished was described, together with reference to analogous experience in other fields.

A full report of the conference will appear in the June issue of *Instrument Practice*. Extra copies of this can be obtained from the Scientific Secretary of the Society, Dr. D. J. Turner, M.R.C. Laboratories, Holly Hill, Hampstead, N.W.3.

BOILER HOUSE PRACTICE

A Major Text-Book

Boiler House Practice, by J. N. Williams, M.I.C.E., M.I.Mech.E., F.Inst.F. Pp. 624, with 238 Figures. George Allen and Unwin, 60s. net.

We can unreservedly recommend the new second edition of this work to all fuel technologists, students and to Smoke and Public Health Inspectors who, having to deal with problems arising from boilerhouse operations, will wish to have at hand a book of reference that is remarkable comprehensive and thorough.

Boilerhouse design, equipment, operation and maintenance is becoming more and more important for both fuel efficiency and smoke prevention, and at the same time, with continually developing techniques, it is growing more complex. More knowledge of technical details and of automatic equipment is called for, and yet it remains as necessary as ever to have a sound and clear understanding of the principles of combustion and the way in which the energy of the fuel is transferred to steam. Mr. Williams covers theory, principles and practical applications in a masterly and engagingly lucid way.

After dealing with the theory and practice of combustion, heat transmission and steam, the book goes on to describe shell boilers, their furnaces, grates and operation. The next chapters are devoted to water-tube boilers, mechanical stokers, superheaters, economizers and air heaters. Then coal, its storage and handling, coke and coke breeze, oil and pulverized fuel are discussed. Next come chapters on boiler control, water, boiler feeding, refractories and lagging, chimney emissions, flue gas cleaning, and finally, maintenance, measurements and tests.

It will be seen that the whole field is dealt with in every aspect. We naturally looked more closely at the chapters on chimney emissions and flue gas cleaning, and found that the former included a useful general discussion on air pollution before proceeding to show how smoke could be prevented in the boiler furnace. It was, however, rather perplexing to see the Meuse Valley fog of 1931, with its 65 deaths, described as probably the most serious example of a fog due to temperature inversion, when on the next page the London disaster of 1952, with a death-roll of 4,000, is discussed.

One drily expressed comment must be quoted:

" One of the curious characteristics of shell boiler practice is the frequency with which features of the plant, installation and operation, would appear to be specifically designed to facilitate smoke formation."

The chapter on flue gas cleaning is also most informative for the descriptions given of the principal methods used—cyclone, electrostatic precipitation and flue-gas washing.

As prices stand today, this book is very reasonably priced at 60s.

Solid Fuels in Flats

A joint committee of the London Regional Committee of the Coal Utilization Council and the London Branch of the Institute of Housing has made an inquiry and published a report on " The delivery and storage of solid fuel in flats."

The report points out that it was not a function of the committee to inquire into the general problems of supply and distribution of solid fuels, nor the wider problem of whether flats should in fact be equipped for burning solid fuel in individual appliances. They were concerned only with the actual existing problems of delivery and storage, and within this field they have produced a report that carefully analyses all the difficulties that arise. A useful series of recommendations is made and should be carefully studied by all housing authorities, architects and builders.

NEWS

Course for P.H. and Smoke Inspectors

A Refresher Course for Public Health and Smoke Inspectors, on combustion and smoke, was held at the Royal Society of Health in London on 27th to 31st May, and a similar course is being arranged for 1st to 5th July, when dust and grit emission and the Clean Air Act will be dealt with. The courses have been organized by the College of Fuel Technology, and the scheme approved by the Royal Society of Health for the training of smoke inspectors. The programme, particulars of fees and other information can be obtained from the College, 90 Talbot Road, Highgate, London, N.6. The College has developed, over the last few years, in conjunction with the National Coal Board, a Tutorial Group method for the training of boiler operators taking the Boiler Operator's Certificate of the City and Guilds of London Institute. The method has now been further developed by the College in conjunction with N.I.F.E.S.

One Day Courses on the Clean Air Act

Under the auspices of the Advisory Committee for Fuel Technology of the Southern Regional Council for Further Education, one-day courses have been organized by local Education Authorities, dealing with the introduction of the Clean Air Act. The first of these courses was held at Portsmouth on 15th May, and another at Reading on 24th May. The plan for the day is of interest. In the morning talks were given on the implications of the Clean Air Act to industry and staff concerned, and on fuel, with particular reference to the prevention of smoke. After lunch those taking part in the course assembled at a works boiler-house, where, divided into two parts, they were given alternately a demonstration of correct and incorrect firing, and practical instruction on the monitoring of smoke emissions.

Bristol Black Smoke Case

Thought to be the first local summons of its kind dealing with smoke abatement regulations under the Public Health Act of 1936, the C.W.S. was fined £5 for creating a nuisance by the emission of black smoke from a 50 ft. chimney at the upholstery and bedding works, Whitehall, Bristol.

The society was given six weeks in which to complete firing system modifications designed to abate the nuisance.

A Public Health Inspector told the court that on a day in November 1956, a day in January this year and another day in March he had observed black smoke coming from the chimney and on one occasion, the top of the stack could not be distinguished. There was dwelling house property in the neighbourhood.

He had spoken to a manager at the works and the City Corporation had given a demonstration of how fires should be stoked. He understood the coal was good and he agreed that the society had a labour problem.

Dangers of Black Diesel Smoke

The emission of black smoke from diesel-engined vehicles—a danger to other drivers and a nuisance to pedestrians—is caused by either faulty maintenance or deliberate interference with the mechanism by drivers. This was the conclusion reached by the Technical and Engineering Committee of the Royal Automobile Club after an investigation lasting several months.

The extent of the problem was ascertained by a survey carried out by road patrols of the R.A.C. and A.A. on 12 hills with gradients varying between one in ten and one in 25. Other interested bodies were then invited to meet the committee and discuss the matter, these bodies including British Road Services, the London Transport Executive, and the London Motor Cab Proprietors' Association.

It was found that black smoke emission, which is a symptom of incomplete combustion of fuel, is most

often caused by an incorrect ratio of air to fuel and/or incomplete atomization of the fuel because of faulty injection. In sum, it is stated, black smoke is usually attributable to faulty maintenance or abuse, or a combination of both.

The report of the committee recommends that too much emphasis cannot be laid on the importance of regular, adequate and competent maintenance of the entire combustion system and in particular the fuel injection equipment and the air filter of diesel engines. Large fleet operators are in a better position to ensure proper maintenance of oil engines than the small operator who may be dependent upon staff more accustomed to petrol engines. Outside assistance is available for these operators.

Smokeless Fuel a Success

Since it was introduced nine weeks before, the North Western Gas Board had sold by 29th March some 6,588 tons of Phimax, its new smokeless domestic fuel. Repeat orders formed just under half of all orders received by distributors and about one-third of orders received by the Board. At present Phimax is being sold only in the Greater Manchester area. By the end of April the Board expects to be able to judge to what extent production should be expanded and in what new districts in its area the new fuel should be made available next winter.

Sales of the new free-burning fuel "Cleanglow," produced and put on the market by the North Thames Gas Board last October, are reported to be rising steadily. Several large users are being supplied by distributors under contract, having transferred from house coal. Notable among them are the Government offices throughout Whitehall.

Coke Fires Satisfy Tenants

A poll of tenants of corporation houses in the Gracemount area, where the use of smokeless fuel was made a condition of tenancy, has shown that most of them are satisfied with coke fires, Edinburgh Health Committee was told on 23rd April. About one-third of the houses in the area which have been occupied for three months or more were visited, and 52 tenants were satisfied with coke fires. Six were doubtful and four were dissatisfied.

Beneath the Grey Blanket

We have published before evidence from flying men on the vast volumes of smoke that drift over Britain, but which can be seen properly only from above. Here is a letter published in the *Manchester Evening News* from a member of the Lancashire Aero Club:

"We read with interest your editorial on smoke nuisance. It may surprise your readers to know that from a height of 2,000 feet above our aerodrome at Barton, Eccles, the cities of Manchester and Salford are invisible beneath a grey blanket of smoke at all times, while pilots can often see Snowdonia and the coastline from Blackpool to Llandudno in the other direction.

"The smoke is not even confined to the city, but drifts in grey streams for surprising distances. On Wednesday of this week, Manchester was receiving, in addition to its own and suburban smoke, a great volume of smoke from Northwich as well, and the combined drift extended well into Yorkshire. It is a common experience for pilots approaching or leaving any city airport to leave brilliant sunshine with visibility of up to 30 or 40 miles to plunge into a grey fog with visibility down to half a mile upon coming within 10 to 20 miles downwind of the city.

"Seen from above the whole problem takes on reality, and it can be quite a shock to find that the home one thought was in the clear is quite often on the receiving end of an immense amount of filth, as well as the countryside which one seeks out for 'fresh air'. Indeed, if those concerned were to see how great the volume of smoke is then something might be done.—*R. B. McH., The Lancashire Aero Club.*"

From our Photo Library No. 29 *Aerofilms Ltd.*

Sun, Streets—and Smoke

Divisional and Regional News

The East Midlands Division of the Society met at Ilkeston on 14th March, when the sixty members attending were welcomed by the Mayor, Councillor Robert Skelton. An address was given by Mr. Vincent Wales, Smoke Inspector at Nottingham, and in the afternoon visits were made to the hosiery firms of Charnos Ltd. and A. Booth & Sons Ltd.

The Council of the Yorkshire Division met at the offices of Radiation Ltd., Leeds, on 1st April. The meeting of seventy members was addressed by Mr. Eric Bellingham, O.B.E., J.P., General Manager of the Solid Fuels Division of Radiation Ltd., who, recalling his experience in local government, said he appreciated to the full the difficulties elected representatives would be up against in implementing the provisions of the Clean Air Act. Mr. Bellingham went on to outline the history of the manufacture of coal burning appliances and the difficulties which were encountered during their development. Members were later taken round the showrooms and a number made a tour of the works and saw appliances and other products during manufacture.

The South East Division is to hold its annual general meeting in London in July, and a series of educational visits for members has been arranged for the summer months.

In the North West Division preparations are being made for a clean air campaign similar to that in the West Midlands. It is being sponsored by the N.W. Divisional Council, with the support of local authorities, the Solid Smokeless Fuels Federation, the Gas and Electricity Boards and other interests.

Among the regional advisory committees of local authorities that for the West Riding Regional Smoke Abatement Committee is now the *West Riding Clean Air Advisory Council*, and the former Midlands Joint Advisory Council for Air Pollution and Smoke Abatement becomes the *Midlands Joint Advisory Clean Air Council*. Dr. W. R. Martine, who has been Hon. Secretary to the Committee for many years, has resigned from the post, and is succeeded by Mr. G. A. Kimberley.

THE APPLICATION OF THE CLEAN AIR ACT TO PRIVATE DWELLINGS*

by W. R. Branson, M.Sc., A.M.I.C.E.†

In the memorandum on Smoke Control Areas issued by the Ministry of Housing and Local Government to local authorities a few months ago, it is made very clear that the main responsibility for the implementation of a clean air policy rests with local authorities. During the six months which have elapsed since Sir Hugh Beaver opened the West Midlands Clean Air Campaign, the local authorities have done a great deal by means of exhibitions throughout the West Midlands to educate the public to the evils of atmospheric pollution and to the means which are available to overcome them. During the six months, the appointed day upon which major portions of the Clean Air Act became operative has been passed and the first Smoke Control Order has been made.

That the first action following the passing of the Act has been directed to education of the public has, I am sure, been a wise decision. Without the support which can only come from an educated public opinion, a clean air policy, with its attendant costs and its interference with the liberty of the citizen to create a smoke nuisance, is doomed to failure.

Most processes of education are two-way and the exhibitions of this campaign have been no exception. Certainly the producers of fuel who have participated in the campaign have had invaluable opportunities for discussion with members of the public as well as with representatives of the local authorities.

In the course of these discussions we have learned of the difficulties, some real and some, we believe, imaginary, which are thought likely to hamper or prohibit the achievement of clean air.

I would like this afternoon to talk about these difficulties and to express my own views thereon as a producer of solid smokeless fuel. If, in doing so, I over-emphasize the views of the gas industry—particularly of the West Midlands Gas Board—I hope that you and the other producers of solid smokeless fuels will forgive me.

Inadequacy of Supplies of Smokeless Fuels

One of the difficulties most frequently raised is that supplies of solid smokeless fuel are inadequate to permit local authorities to implement the provisions of the Act. The Beaver Committee dealt with this point in paragraphs 73–77 of their report and expressed the view that " from the sources we have indicated, enough coke could be found to permit the creation of smokeless zones and smoke-control areas as fast as the administrative action and the replacement of appliances would permit during the next five years at least." All the evidence since that statement was written has tended to confirm it. Indeed, our complaint as producers of smokeless fuel is that the Government, in its anxiety to ensure adequate availability of coke, has ordered conversion from coke to oil by service and other Government Departments and has encouraged industrial and commercial users to do likewise to such an extent and at such a rate that, following a mild winter, gas coke stocks are now at a record high level. Some distributors may, perhaps, have given

* Paper read at a joint conference of the Combustion Engineering Association and Solid Smokeless Fuels Federation in Birmingham on 16th and 17th April to conclude the West Midlands Clean Air Campaign.

†Deputy Chairman, West Midlands Gas Board.

the impression that coke is in short supply. Transport difficulties in severe weather, when demand is at its peak, may lead to delays in delivery of any solid fuel, but there has not in recent years been any shortage of coke.

A recent re-examination of the position in the West Midlands confirms that existing and planned production of gas coke is adequate to permit the replacement of one-third of the bituminous coal now used in the black areas within the next five years. Since this corresponds to the conversion of 320,000 households from bituminous coal at an average rate of over 60,000 per annum, it is not thought likely that supplies of smokeless fuels will prove inadequate in the first five years. Thereafter, further expansion of supplies of gas coke depend to a considerable extent upon a parallel expansion of demand for gas. The great field for gas utilization which still exists in Midland industry makes me optimistic that clean air will not fail because of shortage of smokeless fuel.

Prices

A further point frequently made by visitors to the exhibitions during this campaign has been that the smokeless fuels are too dear. Well, of course, we should all like them to be cheaper. Table I of Appendix X to the Beaver Report compared the cost of useful heat from a wide range of fuels and showed that, in any type of improved appliance, coke provided the cheapest therm. I have taken the liberty of bringing these figures up-to-date and Table I shows the position at prices ruling in Birmingham today. In spite of changes in price since 1954, it is still true that coke provides the cheapest useful therm.

I should be guilty of deliberate misrepresentation, if I led you to believe that reductions in price of solid smokeless fuels were likely to be possible in the future. Such minor economies as may be possible as a result of improved efficiency in production, handling and distribution may, in my view, be more than offset by the increased costs which are bound to follow the transfer of coke from industrial use with its high load factor to domestic use with its seasonal peaks of demand, leading to greater demands on storage grounds and distribution facilities.

Supplies

In the House of Commons the Paymaster General was recently asked whether " he would give a general direction to Area Gas Boards to make available adequate supplies of Phimax to be available at the same price as coal, etc." and we have frequently been asked in recent weeks " when are your Board going to make supplies of special smokeless fuels available?" This seems to be the $64,000 question and, as such, deserves careful consideration and a reasoned reply.

The thought which prompted the question in the House was no doubt that, if supplies of these highly reactive fuels could be made available at the same price as coal, the local authorities would not be faced with the problem of appliance conversion and the householder would continue to enjoy his open fire whilst having the benefit of clean air at no cost to himself or to the local authority.

Now that the appointed day is passed, local authorities are no doubt approaching, if they have not yet reached, the day when the bill for the first smoke control area is added up. If we accept the Beaver Committee's estimate of £10 per house—and my own opinion is that this will prove to be rather too low—the West Midlands is faced with an expenditure of some £3 million in the next five years if one-third of the black areas is to be dealt with. Although the Exchequer will bear 40 per cent or about £1¼ million of this, the local authorities can hardly be blamed for looking around for other solutions and for asking whether the producers cannot offer something which will burn smokelessly in the old-fashioned grates.

Given supplies of suitable coal, it would be possible in existing gasworks plant to produce—at a price—considerable tonnages of highly reactive

cokes which would burn smokelessly and ignite readily in existing stool-bottom grates.

However, the coals need to be carefully selected and in particular to be free from fines below about 1 in. in size. Since the gas yields from these coals, under conditions which yield a highly reactive coke, are low compared with those from normal gas coal carbonized at normal rates and temperatures, the need is for larger tonnages to produce existing gas requirements.

The extension of machine mining and loading with consequent increases in the proportion of smalls in the coals mined is leading to an ever-increasing shortage of large coal. Large coal is currently being imported from the U.S.A. and elsewhere. It is not surprising therefore that, under these circumstances, the National Coal Board hold out little immediate hope of being able to supply the coals required.

Furthermore, in view of the low gas yields per ton of coal when producing these special fuels, the cost of the additional coal, its handling and carbonization, must be borne by the special coke unless the price of gas is to be advanced.

My own estimate is that special fuels of a reactivity suitable for the stool-bottom grate are unlikely to be produced and delivered in the Midlands at a premium of less than 30s. to 40s. per ton over the price of normal gas coke.

It seems improbable, therefore, that such fuels can be produced in sufficient quantities in existing gasworks plants to make a significant contribution to clean air and such small quantities as can be produced are likely to cost appreciably more than normal gas coke.

From the point of view of fuel conservation, the overall efficiency of production and consumption of these special fuels in stool-bottom grates is lower than that of the production and consumption of gas coke in the new improved appliances. If the householder uses two tons per annum, and my estimate of cost of special fuels is correct, then his fuel bill is £3–£4 per annum more with the special fuels than it would be with gas coke—neglecting any difference in efficiency. If we take £6 as the cost of an improved coke burning grate, including the provision of gas ignition, it will be seen that this is repaid in not more than two years by savings in fuel costs. As a temporary measure, where local authorities are anxious to include within a smoke control area property due for demolition in the comparatively near future, special arrangements to ensure smokelessness may be necessary and the provision of supplies of specially reactive fuels may be justified on economic grounds.

Some people will be prepared to pay the higher price for a fuel which is inherently more flexible than coke and which burns with a flame to remind them of the days when they were allowed to burn coal. The market is, however, likely to be a limited one.

Closed *v.* Open Appliances

The English preference for an open fire has been noted in the course of every enquiry into domestic fuel economy and nothing we have heard during this campaign leads us to believe that more than a minority of householders will choose the more efficient closed appliances. That savings in running cost are to be achieved in that way is apparent from Table I E(*i*) where coke burned in a closed stove is shown to provide the cheapest useful therm of any of the fuels listed. It is true that many users will not take advantage of the high efficiency of the closed stove only to save fuel but will prefer to increase their standards of comfort by maintaining continuous heating of their homes. It may be unfair, therefore, to claim that the installation of these more expensive appliances is justified in the interest of national fuel economy. It is, however, worth mentioning that these closed appliances, since they are capable of using, and in fact may preferably be operated on, the less reactive cokes produced by static carbonization processes, help to ease

the supply position of the more reactive fuel required for the open fire. The article by Dr. Foxwell in the current number of *Smokeless Air* is of interest in this connection, particularly the point which he makes that high efficiency and consequent lower fuel consumption reduces the emission of sulphur.

The savings in money and the improvement in health to be gained by cleaning the air are so great that we should be prepared to pay now for these benefits and I hope that local authorities will not—out of a proper desire for economy—follow a course of action which will lead to the installation of the cheapest appliance—possibly badly fixed—without any regard for efficiency and fuel economy. If resources are limited, I would make a plea for proceeding more slowly but for doing the job properly.

It may be thought that what I have said is not very helpful to representatives of the local authorities facing the task of implementing a clean air policy. I have, however, tried to explain the producers' viewpoint on some of the questions which have arisen in the course of the campaign.

Education of the Public

I should now hasten to add that the producers' wish is to be helpful and to do everything possible to assist local authorities in their task. In my view one of the major problems facing us jointly is that of education of the public. We still hear all too frequently statements that it is impossible to use coke or that the use of coke leads to difficulties with fumes. Whilst we know these statements to be untrue, it needs more than words to convince the housewife who is accustomed to other fuels. If local authorities will let us, we are anxious to do everything we can to assist in education of the public by practical demonstration that, with modern appliances, standards of comfort can be attained using smokeless fuel which are at least as good and generally much better than when using raw coal. Technical staff is available to help authorities at any stage in the initiation of a smoke-control area. As an example of what I have in mind, I would refer to the case of West Bromwich, where my Board have fitted up a house with solid smokeless fuel appliances for use in demonstrating to the public their correct operation. We should be glad to give similar assistance to others interested.

Coke Quality

We are conscious that not all the coke distributed is as good as it might be and are doing our best to improve quality. The average quality of coke supplied in this area is nothing of which to be ashamed and would, I am satisfied, meet the Beaver Committee's requirements of "a high quality free-burning fuel that will be completely satisfactory to the domestic consumer when used in modern appliances." Unfortunately, average coke, like the average man, does not exist and the quality of individual consignments varies with variations in coal quality, in gas making conditions and other factors. Deliveries of coal to domestic consumers are, of course, subject to similar variations. It is the major task of the producer to minimize these variations and to keep quality constant within the narrowest practicable limits. It is perhaps worth mentioning that, during the past two years, the average ash content of coal used by my Board has fallen from 6·5 per cent to 5·7 per cent, an improvement which will have been reflected in a drop in the ash content of the coke for sale of over 1 per cent.

In conclusion, may I return to the Ministry's memorandum on smoke-control areas. That memorandum outlines the machinery for consultation between the local authorities and the producers on matters of availability of smokeless fuel and also refers to the advice and assistance which is available to local authorities from the National Smoke Abatement Society, the Solid Smokeless Fuels Federation, the Coal Utilization Council, etc., etc.

In all these matters may I assure you that the producers are most

anxious to be of help in every possible way and that we look forward to co-operation with local authorities throughout the West Midlands in the great task of creating a cleaner Britain.

Table I of Appendix X of Report of Committee on Air Pollution adjusted to prices ruling at March, 1957, in Birmingham

Typical Room Heating Efficiencies	*Type of Appliance*	*Cost in pence per useful therm*
	A. Ordinary pre-war grate (stool bottom with front fret)	
20–30	(1) burning coal	28¾–19
25–35	(2) burning " Coalite "	32¾–23½
	B. Simple improved open fire	
25–35	(1) burning coal	23 –16½
35–45	(2) burning coke	20 –15½
35–45	(3) burning " Coalite "	23½–18¼
	C. Improved open fire with restricted throat or with convection heating	
30–40	(1) burning coal	19 –14½
40–50	(2) burning coke	17½–14
40–50	(3) burning " Coalite "	20½–16½
	D. Openable stove	
35–45	(1) burning coal	16½–12¾
45–55	(2) burning coke	15½–12¾
45–55	(3) burning " Coalite "	18¼–15
	E. Closed stove	
60–70	(1) burning coke	11½–10
60–70	(2) burning " Coalite "	13½–11¾
	F. Gas fire	
45–55	(1) Radiant	39 –32
55–65	(2) Radiant with convection	32 –27
100	G. Electric fire	29½

Prices: Electricity .. .. .. 1d. per unit (assuming all heating is at the following rate in a block tariff).

Gas .. .. 17·5d. per therm (assuming all heating is at the second block price).

(Group H) basic price
Coal .. .. 133s. 10d. per ton = 5·735d. per therm.
Coke .. .. 154s. = 6·97d. per therm.
Coalite (basic price) .. .. 190s. 11d. = 8·18d. per therm.

The West German Government is reported to be investigating the danger to public health from air pollution, following requests by the Lower House of Parliament. West German newspapers, talking of an "air plague" and of " unacceptable annoyance and damage," have stressed that the need for clean air is as important as the need for clean water. The Ruhr is the area most affected.

E.A.W. Conference

The East Midlands branches of the Electrical Association for Women chose as the theme for their conference this year " Clean Air Through Electricity." The conference was held at Nottingham University on 16th April, and an exhibition in support of it was staged by the Nottingham Health Department, the N.S.A.S., and the regional Electricity Board.

TECHNICAL AND TRADE NEWS

The Godber Smoke Burner

Readers will have noted the double-page announcement in this and our last issues about the Godber Smoke Burner. This explains how the burner is designed to achieve the familiar " three T's " which complete combustion demands. The volatiles of the coal and the oxygen of the air must come together at the right *time*, at the right *temperature*, and with sufficient *turbulence* to ensure effective mixing.

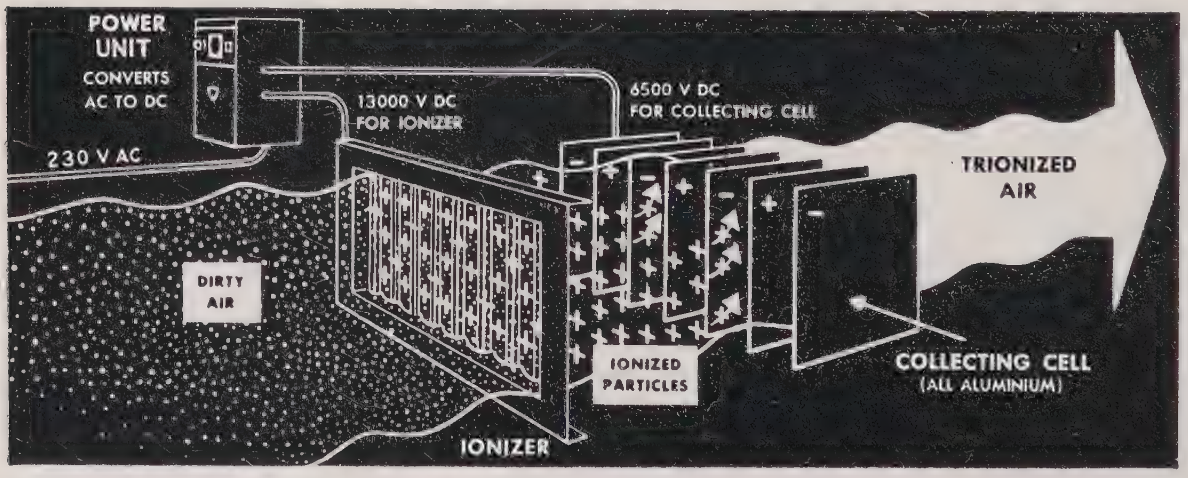
It is claimed that this cannot be thoroughly affected either by passing the air through the firebed, or as secondary air, through the firehole door. In the Godber burner air passes through the firehole doors only during firing and cleaning. Primary air passes through the firebars in the usual way and then secondary and tertiary air enters through adjustable ports at the base of the grate and firebrick support. It passes into a cast iron box beneath the firebridge and is drawn by chimney pull through nozzles in a casting which forms the top of the firebridge. Thus the secondary air is warmed and is brought into immediate contact with the smoke and gases as they pass from the grate. Tertiary air is also introduced from the air-box, passing through a trumpet-shaped casting, and being emitted on a series of jets slightly below and behind the top of the firebridge wall, meeting the smoke and gases just after they have met the secondary air. A firebrick baffle wall is behind the firebridge, forming a combustion chamber in which, with the jets of secondary and tertiary air, violent turbulence takes place and combustion is completed.

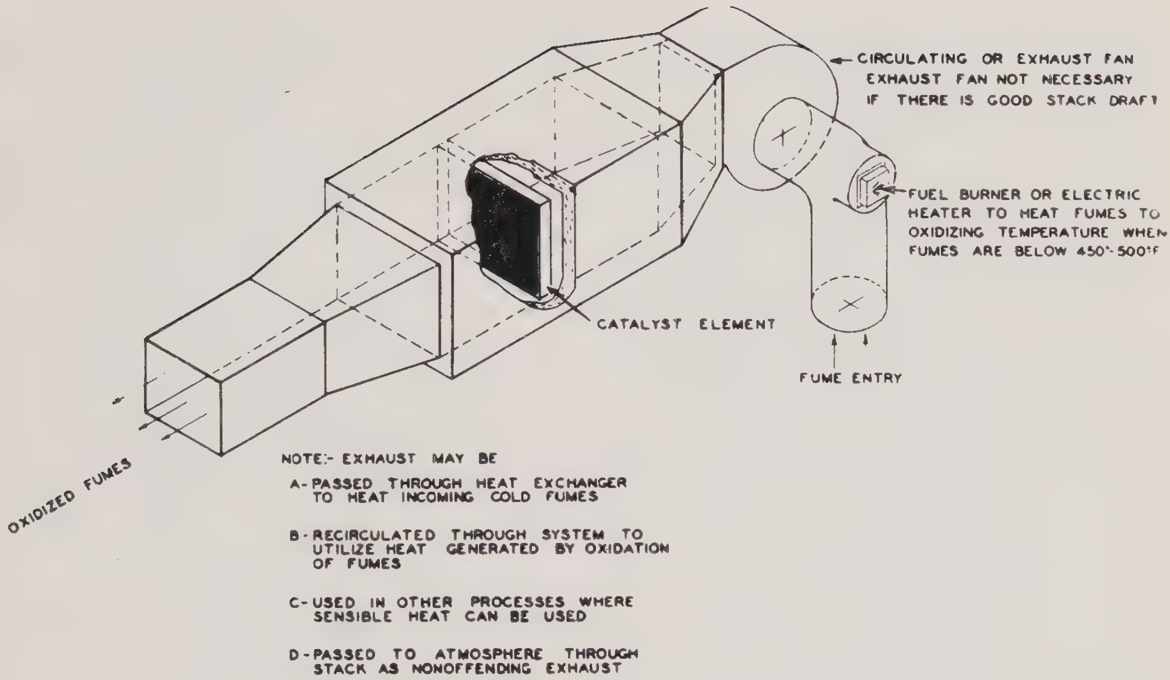
Examples of increased efficiency and more technical details are given in literature that may be obtained from the manufacturers, Smoke Burners, Ltd., 130 Baslow Road, Totley Rise, Sheffield. The principles of the burner are admirable, but naturally it does not do away with the need for careful stoking, care of fires, and other essentials for good technique which are necessary to prevent smoke emission. But with good operation and control this burner should make it much more certain that smoke will be avoided.

Trion Air Filter

The diagram below clearly illustrates the principles on which this electrostatic air filter operates. The particles in the air passing through the filter are electrically charged (positively) as they pass through the high-voltage ionizing screen. They then pass through the aluminium collecting cells, which are charged alternately positive and negative. The particles are attracted to and adhere to the negative plates and are periodically removed by simply opening a valve which sprays the cell with water and washes the dirt into the drain.

This method of air cleaning is marked by the wide size range of





The Holmes-Catco Process

particles removed. Whereas a mechanical cleaner may remove particles down to 5 microns only, the electrostatic filer will be effective down to one-hundredth of a micron. Bacteria average about one micron in size. Resistance is both low and constant, and for 90 per cent efficiency a maximum air flow of only 0·2 in. W.G. is needed. Models of various sizes are available, cased or uncased, and suitable for any size of premises. The smaller sizes require no more electric current than an ordinary lamp.

Trion oil mist precipitators, designed to eliminate coolant oil mist and smoke emanating from high-speed cutting, grinding and machining operations, are also available. This mist can be a serious hazard to the health of plant workers unless it is effectively removed.

Particulars about the commercial applications of the Trion filters can be obtained from the Electronics Division of Harris Engineering Co. Ltd., York Works, Browning Street, London, S.E.17. Inquiries about industrial applications should be made to the Gas Cleaning Division of W. C. Holmes & Co. Ltd., P.O. Box B7, Turnbridge, Huddersfield.

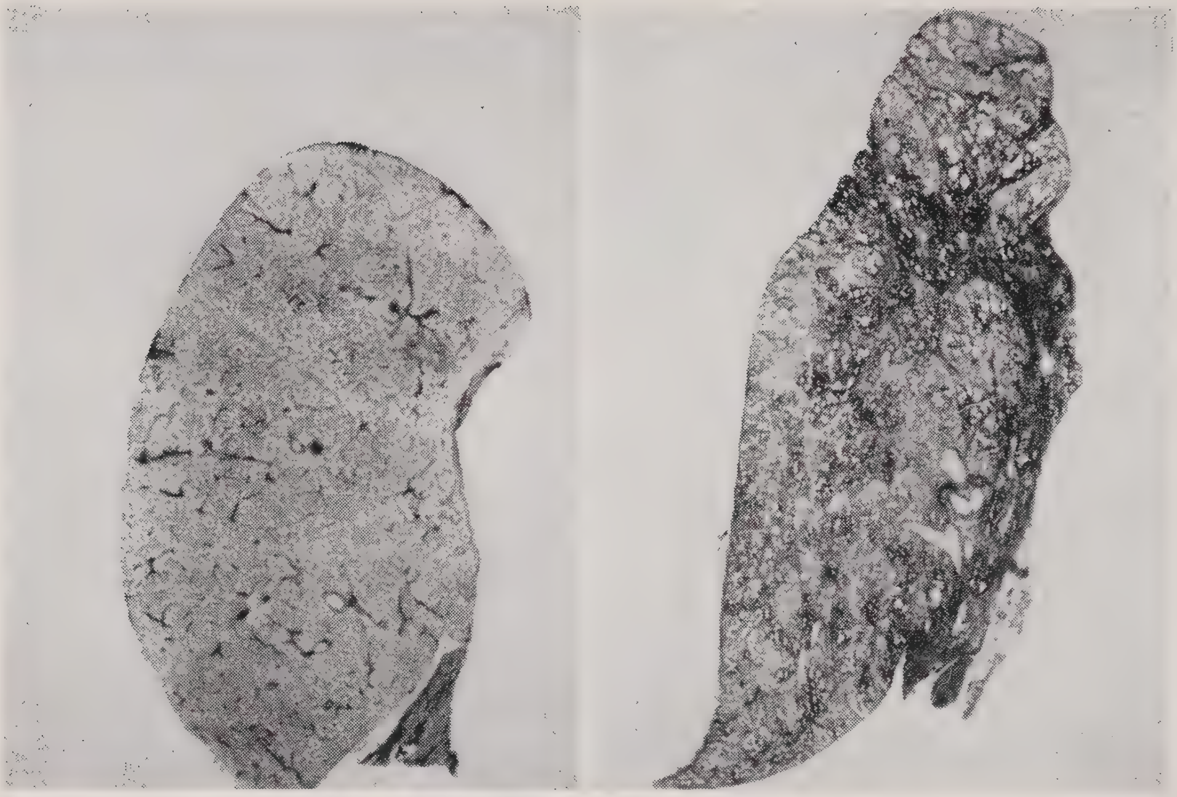
The Holmes-Catco Process

A major cause of atmospheric pollution is the discharge to atmosphere of noxious fumes from industrial processes. This problem has been dealt with for many years, in the U.S.A., by catalytic combustion, a low temperature oxidation process by which objectionable fumes are converted to odour free gases. This process, to be manufactured and marketed in the United Kingdom by the Chemical Engineering Division of W. C. Holmes & Co. Ltd., is to be known as the Holmes-Catco Process.

Fumes, vapours, gases and odours of an organic nature produced in many industrial processes ranging from asphalt blowing to paint manufacture, and from organic chemical plant to paper manufacturing can be treated by the Holmes-Catco Process.

Catalytic combustion is the low temperature, flameless oxidation of combustible fumes and is applied to greatest advantage where the available energy is substantially below the lower limit of flammability.

To maintain normal combustion by flame the two conditions of high tem-



From one of the Society's Exhibits

Photographs of micro-sections of human lungs. That on the left is the upper lobe section from a country-dweller's lung (male, aged about 50), showing little soot accumulation and normal lung tissue. On the right is a section from the lung of a town-dweller, of the same age, showing heavy carbonaceous pollution. The actual sections, mounted in a small stand, are one of the Society's exhibition items, available on loan to members. A full list of exhibits is available on request

perature and a fuel ratio within the flammability limit are necessary. If the fuel ratio is below the lower limit of flammability the flame is extinguished and complete oxidation can then only be maintained by heating the mixture to temperatures of the order of 1,400°F.

Catalytic combustion has no minimum fuel air limits, and the oxidation temperature is no more than 500°F approximately.

The catalyst element is a frame on which a narrow heat and corrosion resistant nickel alloy ribbon enclosed between heat resistant alloy container screens is mounted; a coating of certain metals of the platinum group is bonded to all surfaces of the nickel alloy ribbon to form the catalyst. The element is of sturdy construction, and in general appearance resembles a metallic air filter mat.

The Holmes-Catco plant is extremely compact and can be connected to existing equipment. Running costs are low, and in processes where the heat in the oxidized gases can be utilized, the plant becomes a power producing unit. Being fully automatic the plant requires a minimum of attention.

Speaking at the luncheon held in conjunction with the annual general meeting of the Institution of Gas Engineers in London on 14th May, the President, Sir Henry Jones, said that " if the Government found itself able to relax the restrictions on hire-purchase and to reduce the rate of purchase tax on gas appliances we would make much better progress towards clean air and greater fuel economy. After all, oil-burning and solid fuel appliances are not taxed."

Air Pollution from Power Stations

Some Recent Studies

ALTHOUGH electricity in use is one of the most important means available for obtaining cleaner air there has been concern for a long time over the effects of the concentrated emissions from the great modern power stations. Smoke emission can be practically disregarded: any that is still found in electricity generation will be from older stations that are fast becoming obsolescent. In a modern station coal or oil is burned under conditions of maximum possible efficiency, keeping consumption to the minimum and preventing the loss of combustible material. The misgivings that arise are simply because of the size of the installation, which means that the volume of flue gases from a single source is far larger than from any other type of industrial plant.

Grit and dust are being removed as effectively as is technically possible, but even then the small part that does escape can be quite substantial in weight, while sulphur dioxide is being removed only by the special washing processes in use at Battersea and Bankside. The controversy about whether the expensive wet washing process is of value or not has been going on for some years, it being argued by its critics that a small percentage of gas always escapes, and that this may do more harm in the vicinity of the power station than the whole of the unwashed gases, because it emerges laden with moisture and at a lower temperature. The best remedy, says this school of thought, is to push the gases out hot and fast from high chimneys, so that they get into the upper atmosphere where they become so diluted that they can do no harm. There are indications that this view is gaining ground.

The Central Electricity Authority has not been slow to investigate the problem of power station emissions, both to determine how much trouble they do in fact cause and as a guide to future policy. Some of the results of this work were discussed at a recent meeting of the Institute of Fuel in London (27th March, 1957), when four papers by members of the Authority's engineering and research staff were presented and discussed.

These are of importance, not only for the information they give about power station emissions, but also for the guidance they provide on the techniques of air pollution measurement generally. They demonstrate that power stations, or at least the stations with modern equipment and design, create dust deposits and SO_2 concentrations far less than might be expected. In some instances the influence of the station is difficult to detect. Indeed, as someone jocularly remarked in the discussion, if the C.E.A. continue much further on these lines they will be showing that electricity generation makes the atmosphere purer!

We give summaries and extracts from the four papers.

Routine Surveys of Atmospheric Pollution by Dust and Sulphur Dioxide around Power Stations of the Central Electricity Authority

By W. D. Jarvis and L. G. Austin

Introducing their paper the authors state:

"The rapid development of the Central Electricity Authority has led to the erection of large power stations where more than 2,000 tons of coal are consumed daily at one source, and the products of combustion emitted into the atmosphere will contain

varying amounts of sulphur oxides and gritty matter derived from the coal used. When designing new power stations, and when choosing the sites for new power stations, the Central Electricity Authority have taken every precaution to avoid undesirable effects of chimney emissions on the immediate neighbourhood. Due regard has been paid to the recommendations of a Committee appointed by the Electricity Commissioners in 1932, concerning the minimum height of the chimneys and the effect of the contour of the adjacent land on the dispersion of chimney products, and to the scientific information published since that time. Modern power stations also have highly efficient grit arresting plant such as mechanical grit collectors and electrostatic precipitators, and the dust burden of emitted flue gases is commonly of the order of 0·05 grains per cubic foot.

" The dispersion of chimney emissions from industrial plant into the atmosphere has been the subject of much study by workers in this country and abroad, but the studies have been concerned mainly to calculate from theoretical considerations the maximum concentrations of pollution by dust deposition and sulphur dioxide at ground level. In most cases the theoretical formulae proposed have not been adequately tested by direct measurements, and the published data could not be applied generally to estimate the pollution produced by power stations. Consequently the Central Electricity Authority decided to carry out surveys around all new power stations to measure directly the effect of chimney emissions on the levels of pollution in the neighbourhood. The surveys would serve to indicate whether the precautions of design taken to minimize local pollution were effective, and would also monitor the effect of any modifications to the plant which might be found necessary.

" The surveys were instigated by an atmospheric pollution sub-committee of a C.E.A. Operational Research Committee under the chairmanship of Dr. H. E. Crossley, and the actual observations were carried out by the Divisions of the Central Electricity Authority in which the power stations surveyed were situated."

Methods of Measurement

As far as possible monthly measurements were started at locations round a power station two years before the station was commissioned and continued as it expanded into full operation. The deposited matter was collected in the standard deposit gauge and the sulphur dioxide concentration was measured by the lead peroxide instrument.

In each survey observing stations were located, as far as local conditions would allow, in a symmetrical pattern around the power station, and were distributed over an area having a radius of two miles from the power station. The minimum number of observing stations employed was seven. By arranging the observing stations in this manner it was believed that emissions from the power stations would be collected for the majority of wind directions, and consequently the effect of wind direction on the average for the area would be reduced to a minimum. Also, when considering the siting of individual stations, the shielding of the deposit gauge by nearby objects was kept to a minimum and the sites were chosen to be as free from pollution by immediately local sources as possible, although both these requirements were difficult to fulfil in surveys in towns. In addition, observing stations were in some cases installed downwind of the prevalent wind direction at points where theoretical calculations suggest that the maximum concentration of pollutants would be most likely to occur.

The results obtained from deposit gauges are very variable, continues the paper, even from gauges situated close to one another, and variations from month to month are affected by wind force and direction, rainfall and other meteorological conditions, as well as by the changes of emission in the

neighbourhood which is being surveyed. The rate of sulphation of lead peroxide is also variable. The trends of changes of deposition rates or SO_2 concentrations can only be indicated by considering results taken over long periods. The procedure has been to calculate five month averages for the winter five months November to March inclusive, and for the summer five months May to September. October and April results are ignored as these are months of transition from winter to summer or vice versa.

Results

The paper gives a table listing the surveys which were being operated by the C.E.A. in September, 1956—at 19 different power stations. Relevant details of the plant installed in the power stations is also given. Then follow summaries of the results obtained, first for deposited matter and then for sulphur dioxide, from the surveys that have been running for a sufficient time.

To give one example the summary of the survey at Poole may be quoted:

" Observations began in the summer period of 1950 before the power station was commissioned, and the average rate of deposition for this summer five month period was 6·5 tons/sq.mile/month. After the commissioning of the power station in December, 1950, the average rate of deposition varied between 6·1 and 8·8 tons/sq.mile/month, and these small variations showed no correlation with coal consumption at the station, although consumption rose to nearly half a million tons of coal per annum. In the winter period, 1954–55, when the coal consumption for the five months was a maximum of 280,000 tons, the average rate of deposition was 6·6 tons/sq.mile/month, i.e., the same as that before the power station was brought into operation."

The sulphur dioxide records are variable; for the summer periods some show an increase over previous averages, but others do not. For the winter periods there have been some considerably higher averages, even when the amount of coal consumed in the power stations has not been increased, and in general there is no clear correlation between the average sulphur dioxide concentrations observed and the amount of sulphur in the coal consumed. In fact, the increases in sulphur dioxide concentrations which occurred on putting into operation a power station have been obscured by variations in the background levels of pollution over the period of the surveys. Generally, there is two or three times greater concentration of sulphur dioxide in the winter months than in the summer. " This increase occurred at power stations where there was little difference in the summer and winter coal consumptions and indicated that at the most only a minor proportion of the sulphur dioxide was derived from the power station. No relation was found between large changes in the amounts of coal burned and the variations of the average sulphur dioxide concentration between comparable periods.

The winter period increases have been found to coincide with increases in what is called the " national average " based on the records from all measuring stations throughout the country. This might be due, it is pointed out, to a real increase in the sulphur dioxide content in the air or to conditions which affected the sulphation of lead peroxide.

Grit Deposits

Discussing the records obtained for insoluble deposited matter, the paper says:

" The disadvantage of considering five month area averages is that these figures might obscure indications of increases in deposition. It is much more difficult, however, to recognize trends in monthly averages, or monthly single determinations, due to the relatively large fluctuations caused by influences such as rainfall, and wind conditions. In the Croydon and Doncaster surveys, while the efficiency of grit collection at the power station was unsatisfactory in the preliminary

periods of the survey a good correlation was obtained between the amount of coal consumed at the power station and the observed increases in the five month average rates of deposition of insoluble matter in the area surveyed.

" In all the surveys, excluding only the above-mentioned periods at Croydon and Doncaster, there was no correlation between the changes of coal consumption at the power station and the average rates of deposition in the area around the station. Furthermore, the results of surveys conducted before and after a power station was commissioned showed that the increases in the average level of pollution by dust deposition have been insignificant. Higher efficiencies of dust collection have been attained in British power stations than elsewhere in the world, but even so it would seem that only a small fraction of the dust emitted has fallen within the survey areas, i.e., within a distance of two miles from the power station. This conclusion is supported by results obtained from an intensive survey around a power station where the amount of ash emitted was measured during the survey period, and experiments with balloons, described elsewhere, also suggest that most of the dust does not fall close to the power station but is dispersed over a wide area, so that its effect at ground level is small even compared with natural pollution. This is a conclusion of some importance, as a statement has been made that ' if the chimneys in a square mile emit *A* tons of ash per month, gauges in the district will receive an average deposit of about *A* tons of ash/sq.mile/month.' This statement does not appear to take account of the buoyancy of the dust which can escape from the precipitators of a modern power station."

Conclusions

The authors' conclusions are as follows:

" The pollution surveys carried out around a number of modern power stations with high chimneys and efficient grit arrestors have shown that the rate of dust deposition in the neighbourhood of the power station has borne no relationship to the amount of coal consumed and that the increases in the average level of dust deposition which have occurred when modern power stations have been put into operation were less than the casual errors observed in deposit gauge results.

" The effect of power station emissions on the average sulphur dioxide concentration at ground level within a two mile radius of the power station has been masked by the many variables involved, particularly the influence of nearby sources of pollution and the changes in the background concentration of sulphur dioxide which have occurred during the periods the surveys have been carried out. The maximum concentration of the power station is believed to be less than 0·2 mg. SO_2/100 sq. cm/day, and it is doubtful whether the lead peroxide instrument can significantly detect changes of this amount. For this reason other methods of measuring sulphur dioxide concentrations, using short-period determinations, would probably provide more reliable information on the changes which occur."

A Survey of Dust Deposition in the neighbourhood of a Power Station

By

G. England, C. J. Crawshaw and H. J. Fortune

This paper discusses the methods used and records the results of an intensive survey made during the period December, 1952 to September, 1954, at one selected power station. It was considered that for the purposes of this survey a pulverized fuel-fired power station equipped with electrostatic precipitators and having reasonably high stacks should be selected. Ideally, the station should be situated in flat country and be remote from other sources of industrial pollution. An examination of possible sites fulfilling these requirements led to the decision

to survey the neighbourhood of Little Barford Power Station in the Authority's Eastern Division.

This 120MW station was brought into service over the period 1941–42. The four boilers each of maximum continuous rating 300,000 lb. of steam per hour are served by two chimneys 275 feet high. The precipitators of this 15-year-old station are small by modern standards and a study of precipitator efficiency tests results suggested that the total emission of dust from the station would be broadly comparable with the estimated emission from the much larger stations fitted with more efficient grit arresting equipment, which are at present under construction. The Little Barford Station could be expected to have a greater effect on ground level pollution as the chimneys are not high compared with those of 400 to 500 feet now being provided, and as the gas efflux velocity and the quantity of gas discharged from each chimney are both lower than for more modern stations.

The power station is situated in open country with no large industrial plants close to it. Within three miles of the station there are the small township of St. Neots and the villages of Eynesbury, Eaton Socon and Tempsford. The nearest towns are Biggleswade, 7 miles due south, and Bedford, 9 miles to the south west. Within a radius of 25 miles are Kettering, Wellingborough, Luton, Cambridge and Peterborough.

The surrounding country is comparatively flat but there is a low ridge one mile to the east of the power station rising gently from a general ground level of 60 ft. O.D. to a height of 125 ft. O.D.

Scope of the Investigations

The ultimate aim of the Authority's work in this field is to obtain as full an understanding as possible of the behaviour of dust leaving a power station chimney. The immediate aim was to measure the effect of this particular power station on its neighbourhood. The work undertaken fell into three parts:—

(1) The measurement of the amount of dust which fell at different distances and in different directions from the power station.

(2) The measurement of the quantity of dust emitted from the power station under various operating conditions and the measurement of the free-falling speed characteristics of the dust.

(3) The measurement of relevant meteorological variables such as rainfall, wind speed and direction, and station variables such as the emitted flue gas volumes and temperatures.

Method

The standard deposit gauge was used, and 17 gauges were distributed as uniformly as possible around the station and within $2\frac{1}{4}$ miles of it. The measurement of dust emission *from* the power station was complex because of many variables. There are boilers by two different manufacturers at the station, the quality of the fuel varies, and the changes in the demand for electricity call for wide variation in boiler outputs which affect the grit collecting performance of the combustion chamber itself and of the precipitator. There are also the special effects of soot blowing and starting up.

Direct measurements were made of the emission to the chimney from each boiler for a range of boiler loads, using standard test sampling apparatus.

Results

The deposition results, averaged over four periods, were as shown at the top of the next page.

The emissions from the power station, as estimated and expressed in tons per month, averaged for these four periods, were respectively: 353, 183, 281 and 192 tons per month.

Deposits in Tons/sq.mile/month	December 1952 to March 1953	May 1953 to September 1953	November 1953 to March 1954	May 1954 to September 1954
Total Solid Deposits	4·7	8·6	4·1	7·9
Insoluble Deposits	1·5	2·6	1·2	2·5

The water soluble matter collected in the deposit gauges accounted for about 70 per cent of the total. As the water soluble proportion of the precipitator fly ash did not normally exceed 3 per cent it is apparent that the soluble component of the gauge deposit cannot be attributed to the emission from the power station. For this reason only the insoluble portion of the deposits has been taken into consideration.

There was little evidence that any particular area around the power station had a rate of deposition consistently above the average and the average deposition of insoluble matter, as measured by the standard deposit gauge, was in the range of 1 to 3 tons per sq. mile per month. This is compared with figures typical of various types of district, and shows the deposition rates around Little Barford as those characteristic of a rural area.

Examination of the deposits showed that they contained much less ash than the material emitted from the power station, while in cases of large deposits it was invariably found that they contained large proportions of soil, sometimes as much as 90 per cent.

The detailed tables of results that are given in the paper show that only a small part of the estimated emission from the station is found within the the survey area. For some months deposit gauges were placed further afield up to seven miles from the power station. These resulted in low deposit readings and contained very little power station dust.

The fineness of much of the dust and the way in which it is emitted in hot gas from reasonably tall chimneys would appear to ensure that the dust enters the vast stream of air passing over the earth's surface, which results in only a small proportion of it falling within $2\frac{1}{4}$ miles of the station and almost undetectable deposits at ground level at greater distances from the station.

Certain Aspects of the Deposition of Dust

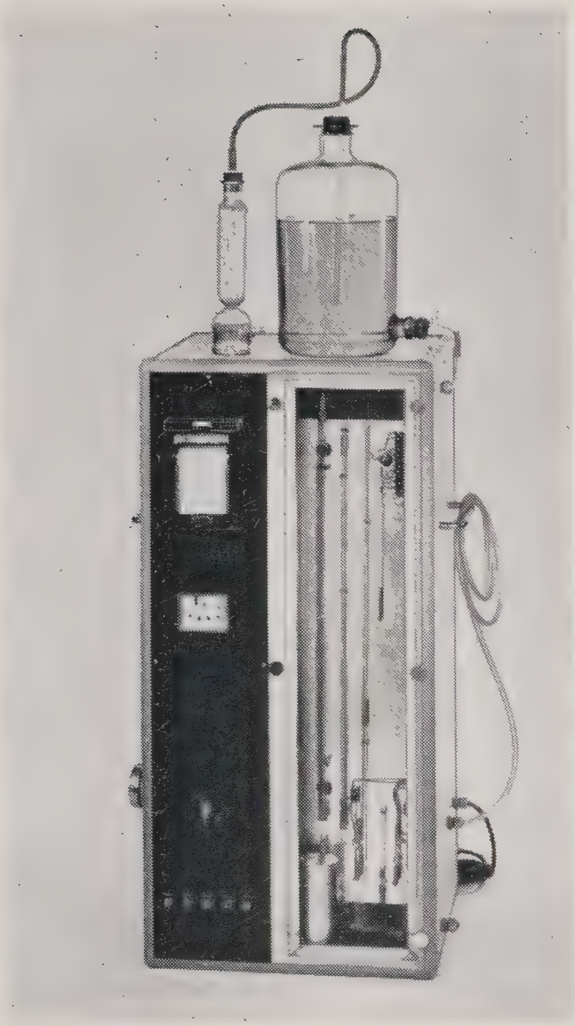
By D. H. Lucas

The measurement of the deposition of dust around Little Barford Power Station was carried out with the standard deposit gauge. However, there were some misgivings about the accuracy and significance of the results and it was decided to carry out some parallel investigations on the nature of deposition and on the performance of the gauge itself.

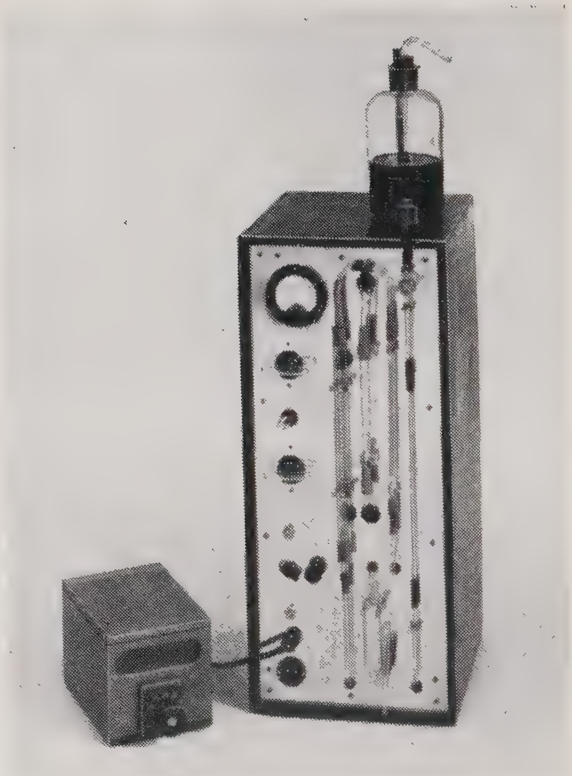
Experiments were carried out with different types of gauges—a ground level gauge; a metal box with a small aperture to represent a window and a small chimney, so that it should represent as far as possible a room in a dwelling house; a horizontal sampling gauge; and modified standard gauges. Balloons were also used to simulate the behaviour of dust and gas.

From the detailed results that are recorded it is shown that a ground level gauge collects a proportion of spurious deposit that is blown along the ground, and that the standard gauge does not retain all the dust which settles in it. If the funnel of the standard gauge is kept half full of water it gives results which on the average are twice as high as the unmodified gauge and on occasion are five or six times higher. Thus while it appears that the results of the Little Barford survey should be doubled in making a comparison with results from other parts of the country, these results should be doubled also.

The paper reaches the conclusion that in the Little Barford survey approximately one-quarter of the dust collected in deposit gauges came from



Automatic Sulphur Dioxide Recorder



Portable Sulphur Dioxide Recorder

the power station. Only a small proportion of the dust emitted falls within two miles of the station.

Instruments for Measuring small Quantities of Sulphur Dioxide in the Atmosphere

By W. G. Cummings and M. W. Redfearn

The fourth of the papers describes an automatic recorder and a portable meter that have been developed at the Research Laboratories of the Central Electricity Authority, for measuring small quantities of sulphur dioxide in the air. The instruments were required not only for average concentrations but also the peak concentrations. The latter occur for extremely short periods, and for a realistic assessment of the degree of sulphur dioxide pollution it is desirable to obtain continuous records over long periods.

The recorder devised and described in the paper is intended to operate on a fixed site. The need was found for a small mobile instrument for rapid measurements at various points in a selected area. Both instruments are sensitive to 1 part of sulphur dioxide in 100 million parts of air over the range 0–50 parts per hundred million. The cost of the instruments has been kept to a minimum and long field trials have proved their reliability.

In the automatic recorder the sulphur dioxide in the air is absorbed by a hydrogen peroxide agent in a continuous counter-current absorption column. This results in the formation of sulphuric acid in the reagent solution and the increase in conductivity of the latter is measured. In the portable instrument the sulphur dioxide in the air reacts with a starch-iodine reagent in a counter-current absorption column. The amounts of light absorbed by the unchanged and the partially decolorized reagent are

compared by photo-electric cells connected to a galvanometer.

Patent applications have been filed for these and other instruments mentioned in the paper. The application numbers are 4706/57, 4730/57, 4754/57 and 4820/57.

Interesting results have already been obtained with these instruments. With the portable meter values have ranged from 0 pphm (parts per hundred million) in country districts in windy weather, through 20–30 pphm in towns on cold days, to 70 on slightly misty evenings in town. Abnormally high values up to 140 pphm have been obtained in a town during fog.

It is also possible to determine the sulphur dioxide concentrations in the path of the plume at increasing distances from a stack. Thus, at one power station, in fine weather with a moderate wind, no sulphur dioxide was detected upwind of the stack, whereas in the path of the plume, at ground level, the concentrations, in parts per hundred million, at varying distances from the stack, were as follows:

0·4 miles	3
0·5 ,,	6–24
1 mile	8
1·6 ,,	2–8
3 ,,	0

Russia's Clean Air Campaign

How Russia is combating air pollution was described to delegates at the Royal Society of Health Congress by Professor Konstantin G. Berushev, assistant professor of communal hygiene at the Central Institute for Advanced Training of Doctors.

Professor Berushev, one of three Russians who were at the congress, told his audience that one method used to protect the population from industrial smoke, dust and gases was to prohibit housebuilding near factories. This was done by setting up protection zones. Width of these zones varied from 50 to 1,000 metres, depending on the quantity and character of the air pollution and the presence of effective anti-pollution equipment. " If the equipment is inadequate," he said, " or if the abatement of air pollution is impossible, the width of the protection zone may be doubled on the demand of the sanitary department."

New items in Russia's sanitary legislation are standards for determining the degree of purity of the atmosphere. These standards consist of a list of air contaminants and their maximum allowable concentrations in the atmosphere of polluted areas. The professor explained: " The maximum concentration must have no harmful or unpleasant effect on man, either directly or indirectly, it must not lower his working capacity, nor alter his feelings or mood. The State Public Health Inspection Board has approved standards for the control of 16 air contaminants."

All existing manufacturing plants were obliged to provide equipment for the control of air pollution within a period set by the health department, he said. " In addition, residential and public buildings are heated from the town's central heating system. Power stations, industrial and residential boilers are being supplied with gas and the railroads are being electrified."

Professor Berushev was taking part in the discussion on Mr. J. D. C. Woodall's paper on atmospheric pollution and the demand for smokeless fuels.

Manchester Hospital Boilers

The Ministry of Health has approved the plans of the North-West Regional Hospital Board for boilers at the Christie Hospital, burning solid smokeless fuel. Manchester City Council has bitterly opposed this throughout, as it is estimated that while the chimney will be smoke-free, it will emit 67 tons of sulphur dioxide each year. The Council advocated the installation of gas-fired boilers, but the Ministry of Health says they would be uneconomic.

SMOKE PREVENTION ABSTRACTS

283. Economics of Boiler Flue Cleaning. Wordley, W. A. (Cheap Steam, Oct. 1956, **40**, 68-70). Observations were made at a boiler plant consisting of six newly cleaned Lancashire boilers. The cost of external and boiler flue cleaning was assessed. Data was obtained to show how the efficiency of a boiler (operating at 9,000 lb of steam per hour and 155 lb/sq.in. gauge) depreciated during steaming hours from clean to dirty condition. Curves were drawn to show:—the cost of extra coal which has to be burned per hour in order to compensate for depreciation of efficiency and the cost per steaming hour of cleaning. An analysis of these curves showed that it was desirable to clean each boiler after steaming for 260 hours at an average output of 9,000 lb. of steam per hour. More frequent flue cleaning also considerably reduced grit emission. When flues were cleaned after 260 hours, practically all grit and dust from the boiler furnaces was deposited and remained in the flues. At 260 hours it was proved that the flue gas speed had increased to such a figure as to prevent deposition of grit and dust. (D.S.I.R.).

284. Physicochemical Dust Suppression in Final Products. Wallace, B. P. (Pittsburgh: Industrial Hygiene Foundation of America, 1955, Trans. Bull. 28, "Transactions of 19th Annual Meeting, November 1954," 209-215). Methods for suppression of dust in handling pulverized hard coal tar pitch and pulverized bituminous coal are described. In the first method the powdered product is treated with a substance which causes the fines to attach themselves to the larger particles in a tenuous manner, i.e. just stick on the larger particles so that part with the slightest shearing action. The method used consists of spraying the pulverized substance with an emulsion while continuously agitating it. The treatment and the emulsion are selected so that they cause no irreversible chemical or physical change in the pulverized substances. For coal, asphaltic resin emulsions are used and in the case of pitch, petroleum wax emulsions are employed. The second method is based on the use of an humectant. The third method, agglomerating or pelletizing, consists of slightly wetting the material with a dilute solution of soluble gum. Heat is then applied and as the moisture dissipates the gum becomes sticky and all the fine particles attach themselves to larger particles and to each other. Heat is continued until the moisture is all driven off. The product is more granular in nature and very flowable. This process can only be used where heat can be applied to the product. Research is in process on a fourth method, that of generating a very strong static charge on all particles and causing clumping. (D.S.I.R.).

285. Dust Extraction in Coke Oven Plant. (Coke & Gas, Nov. 1956, **18,** 447-449). Dust extraction plant has been installed at the Ebbw Vale works of Richard Thomas and Baldwins Ltd. in association with the coke grading plant. Each band conveyor throw-off is hooded in and provided with a suction duct: all shoots and breakers are similarly provided. The main suction duct leads to a washer filter installation, employing the Drummond system. This is described. Its efficiency on coke dust at usual concentrations is over 98 per cent. (D.S.I.R.).

286. Gases Cleaned by the use of Scrubbers. Basse, B. (Blast. Furn., Nov. 1956, **44,** 1307-1310, 1312). Venturi scrubbers are among the most efficient devices available for removal of fine fumes from gas streams. They are especially applicable to the steel industry which, because of the high temperature furnace reactions, produces very large quantities of sub-

micron metallic fume. For air pollution applications, the power required can be adjusted to meet nearly all local ordinance demands, or visual appearance requirements of management. In blast furnace applications, the scrubber supplies sufficiently clean gas so that secondary cleaners are not required before burning the gas in stoves and boilers. (D.S.I.R.).

287. Measurement of the Optical Density of Smoke in a Chimney. Littlewood, A. (J. Sci. Instrum., Dec. 1956, **33,** 495-499). An instrument is described for recording the optical density of smoke in a chimney. It was designed for the study of smoke emission from domestic-heating equipment at the Fuel Research Station, and its readings are independent of changes in the characteristics of the components and of variations in the electricity power supply. This is achieved by using a double-beam, null balancing system with a single light source and a single barrier-layer photoelectric cell. (D.S.I.R.).

288. British Types of Dust Collection Equipment. Wilson, A. (Fuel Effic., 1956 (Nov.), **4,** 782-6; Steam Engr., 1956 (Dec.), **26,** 75-8). Settling chambers, bag filters and cyclone collectors are described. Some details of performance are given. (B.C.U.R.A.).

289. A New Dust Collector. Anon. (Colliery Guard., 1956 (Sept. 20), **193,** 362). The " Cycol " dust collector described and illustrated has an operating efficiency of 100 per cent on particles larger than 30μ. and 80 per cent on those of 12μ. It is self-cleaning and costs less than most other collectors. (B.C.U.R.A.).

290. Electro-precipitation: a Method for the Recovery of Process Fumes and Dust. Heinrich, R. F. and Anderson, J. R. (Brit. Chem. Engng, 1956 (Dec.), **1**, 418-23.) The theory and practice of electro-precipitation is discussed. There are basic equations from which certain calculations for precipitator design can be made, but it is not at present possible to formulate equations relating the efficiency of particle removal to secondary influences such as the re-entrainment of particles and their electrical resistivity. It is believed that the efficiency is also affected by other factors not yet fully known. (B.C.U.R.A.).

291. Seeking New Sources of Gas Production. Smith, Sir H. (*Fin. Times*, 14th May 1957.). With the decline in available supplies of coking coal, and the increased demand for coke consequent upon the Clean Air Act, it is necessary for the gas industry to look for other sources of supply. Two processes have been developed for converting heavy oil residue direct to gas by the aid of catalysts. Resulting gas has combustion characteristics similar to those of normal coal gas. Further research has made possible the use of almost any feedstock or distillate. Gasification plant has been erected at an oil refinery to use such feedstocks. Arrangements have also been made to use tail gases normally flared to waste.

Plants for the gasification of oil are also being erected. One oil gasification process yields, as a by-product, quantities of valuable carbon black. Research is being continued into the possibility of completely gasifying small non-gas-making coals. The search for natural gas is continuing, and at the same time a comprehensive survey has been made of the possibility of importing natural gas in the form of liquid methane.

Future developments are envisaged in which a comparatively small number of gas plants are sited near colliery districts and oil refineries, the resulting gas being discharged into a national grid. The greater efficiency of the industry is discussed, and the point made that increased costs, so far absorbed, may in future have to be passed on to the consumer.

292. The Koppers-Totzek Gasification Process. Koppers, H. H. (Paper read to the Inst. Fuel, 10th April, 1957). Coal, oil and wood are not

only fuels, which produce heat, but are also the main raw materials containing carbon. Carbon itself, as an essential ingredient of all organic compounds and as a cheap means for the reduction of water and ores, has greatest industrial importance. Varying and, often, unsuitable properties of natural fuels make their technical application difficult and have again and again stimulated the search for a simple method of recovering carbon in a uniform and useful state. The best form in which to do this is as carbon-monoxide. New and promising chemical syntheses on a gas basis required a process permitting the production of this standard gas in unlimited quantities. This work was done by the author's firm especially under the direction of F. Totzek and led to a new process for synthesizing gas from any kind of solid, liquid and gaseous fuels. The wide field of its application has become internationally known as several plants of this system have been in successful operation for years. In the process coal dust is entrained and gasified with oxygen and steam so as to form a gas rich in carbon monoxide.

W.A.C.S.F. Annual Conference

Dame Evelyn Sharpe, Permanent Secretary to the Ministry of Housing, Local Government and Welsh Affairs, addressed the 13th Annual Conference of the Women's Advisory Council on Solid Fuel, recently, in London.

One question she felt it important to ask. Would smokeless fuels be available in sufficient quantities? At the moment the Ministry of Fuel and Power was quite satisfied there were adequate supplies; but whether these would continue to be equal to the demand must depend on that demand. "If we get requests from local authorities for permission to establish smokeless zones, we do consult with the Ministry of Fuel and Power to make sure there is sufficient in the area. They anticipate a steady expansion of supply."

Speaking of the introduction of smoke control areas, Dame Evelyn referred to the provisions for meeting part of the replacement costs of appliances. Not all the dwellings in areas liable to pollution would require adaptations. A substantial number had modern appliances, many more were slums which were to be pulled down. In fact, this was obviously the right moment to have a real drive for clean air, because the Government were having a real drive on the slums. "We must keep the clean air policy marching in step with our policy of development and rebuilding." One administrative problem was to ensure that local authorities operated this scheme quickly enough.

During the discussion which followed Dame Evelyn's paper Miss Judith Ledeboer emphasized the need for an open type of convector fire which could, like the openable stove, be installed without bringing several building tradesmen on to the job. The openable stove, however, was expensive and many people insisted on the open fire. It should be possible, and it was not an unattainable ideal, to buy an appliance at a builders' merchant and install it as simply as an openable stove. Miss Ledeboer also said that she thought the implementation of the Act would be a very difficult one for local authorities to handle; it would need vast quantities of propaganda beforehand.

No Bed of Shavings

The retiring chairman of the National Sawmilling Association, Mr. J. G. Sadd, speaking at the Association's annual luncheon, as reported by the *Timber Trades Journal*, said that "Political interference in industry and commerce continued as vigorous as ever. The latest examples were the Clean Air Act and the Restrictive Trades Practice Act. These new and heavy burdens emphasized the vital importance of a virile trade association affiliated to even stronger bodies. . . ."

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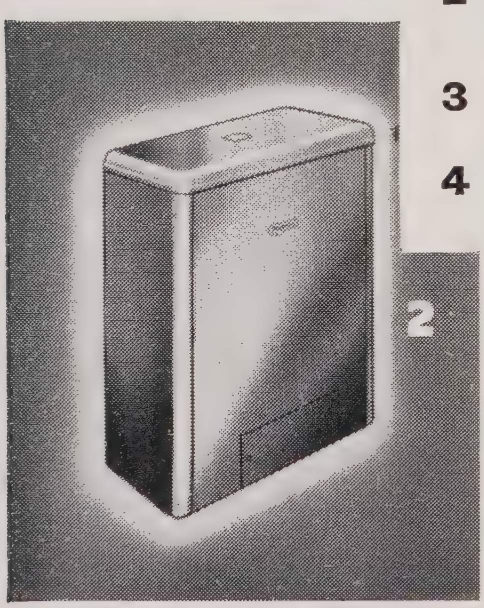

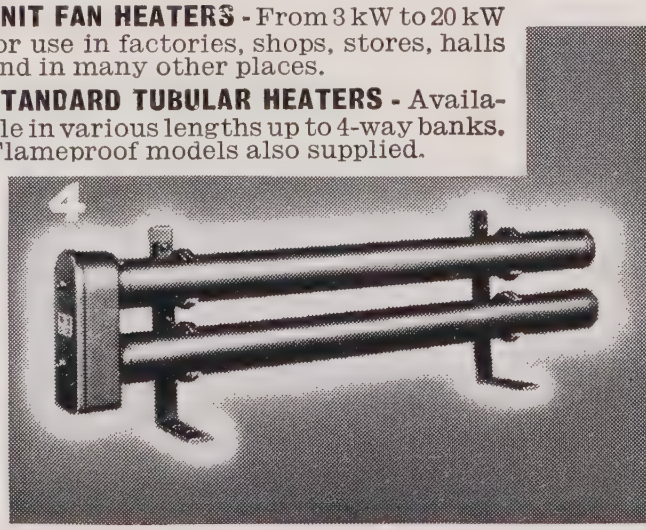

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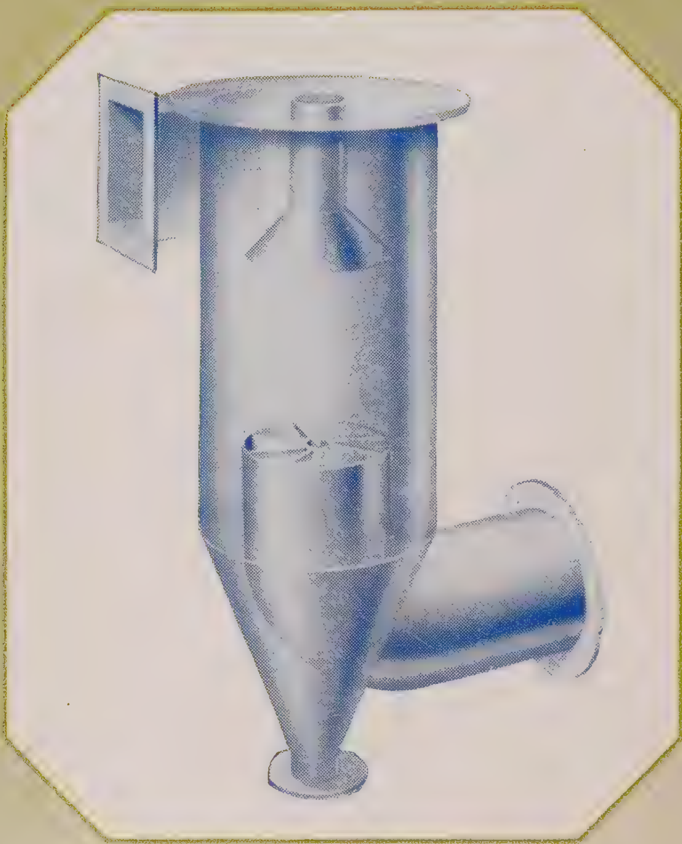

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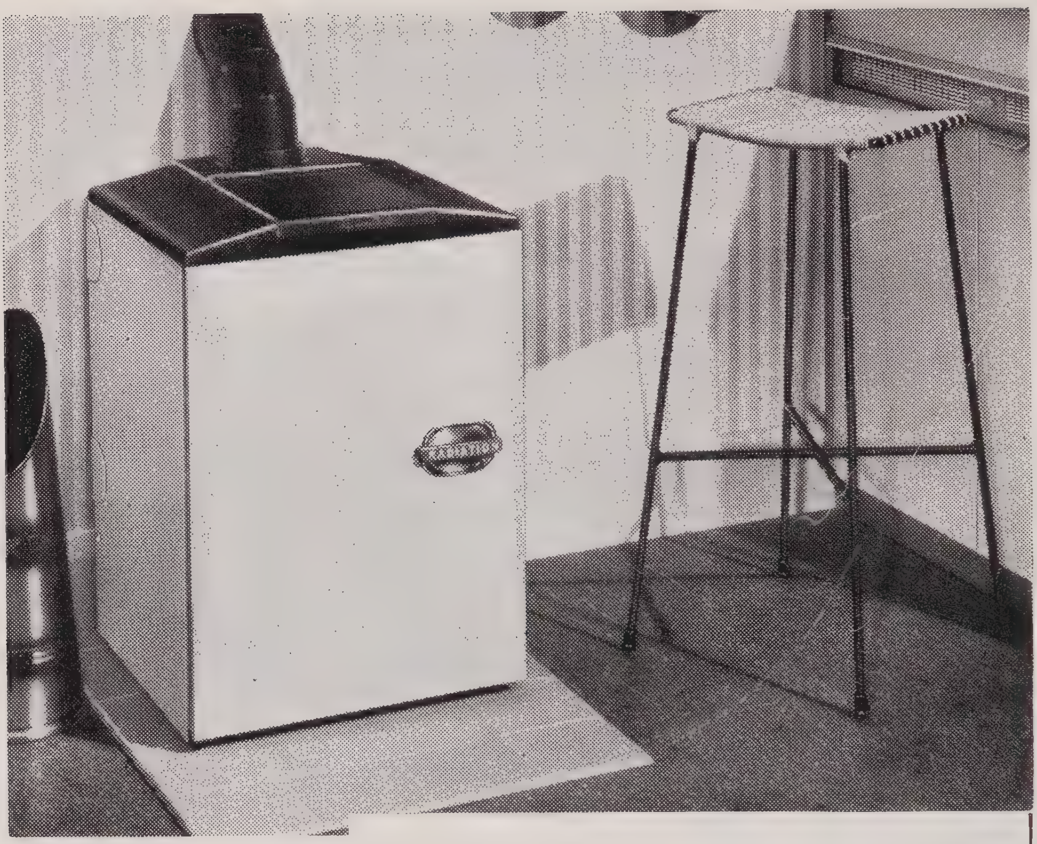
SMOKELESS AIR

JOURNAL OF
THE NATIONAL SMOKE ABATEMENT SOCIETY

No. 103 ★ AUTUMN 1957 ★ 2/-

In this Issue



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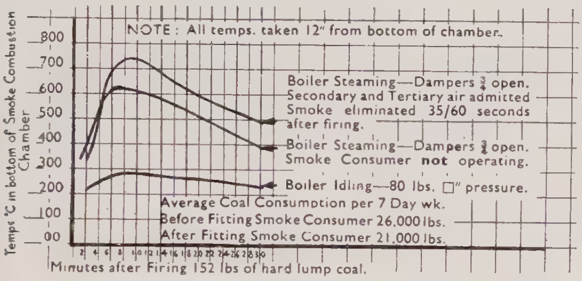
Reproduced below by kind permission of the London and Scandinavian Metal Co. Ltd. of Rotherham is a graph showing extra heat evolved in their 30′ x 8′ Lancashire Boiler. This is of course, secondary to the main purpose of the Godber Smoke Burner—effective smoke control.



The Godber Smoke Burner can be fitted to a 2 flue furnace in approximately 10 hours. As the Godber Smoke Burner is contained within the flue of the boiler no modifications to the shell are required. British Patent No. 743650.

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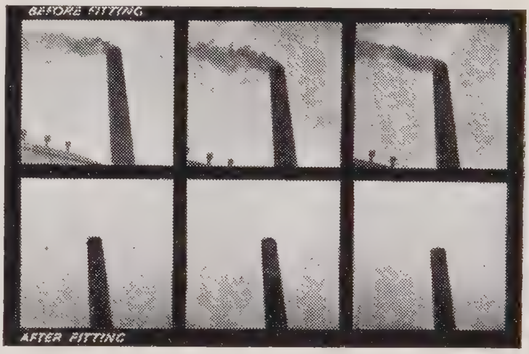
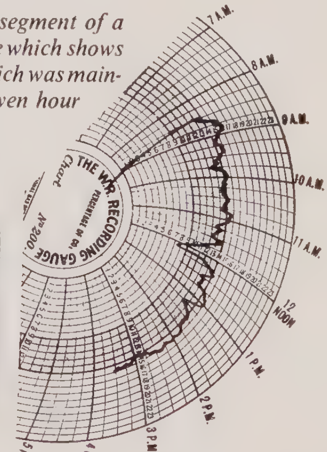
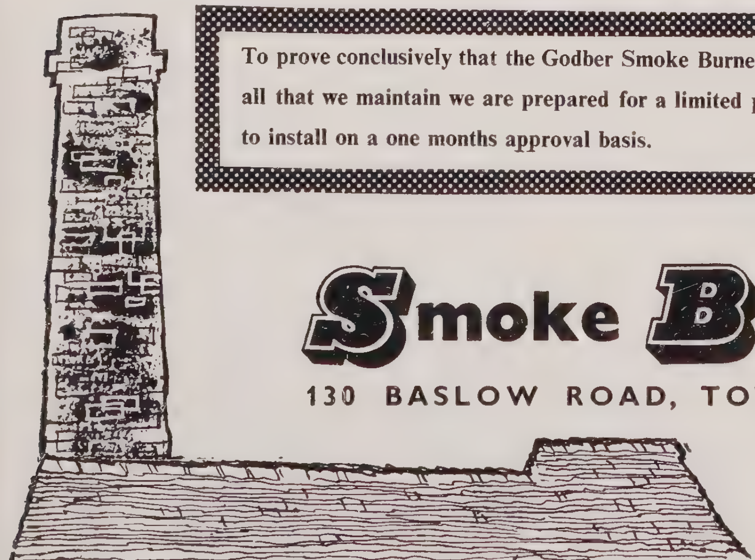


How effectively smoke is controlled is indicated by the unretouched photographs shown here. The 'before and after' shots relate to a hand fired natural draught Lancashire Boiler. The damper settings were identical. One cwt. of large nuts was fired to each grate and the photographs taken at the instant when fire doors were closed and at 15 second intervals. Conclusive evidence of the efficiency of the Godber Smoke Burner.

Reproduced here is a segment of a C.O.2. recording gauge which shows approximately 14% which was maintained throughout a seven hour test on a hand fired Lancashire Boiler.





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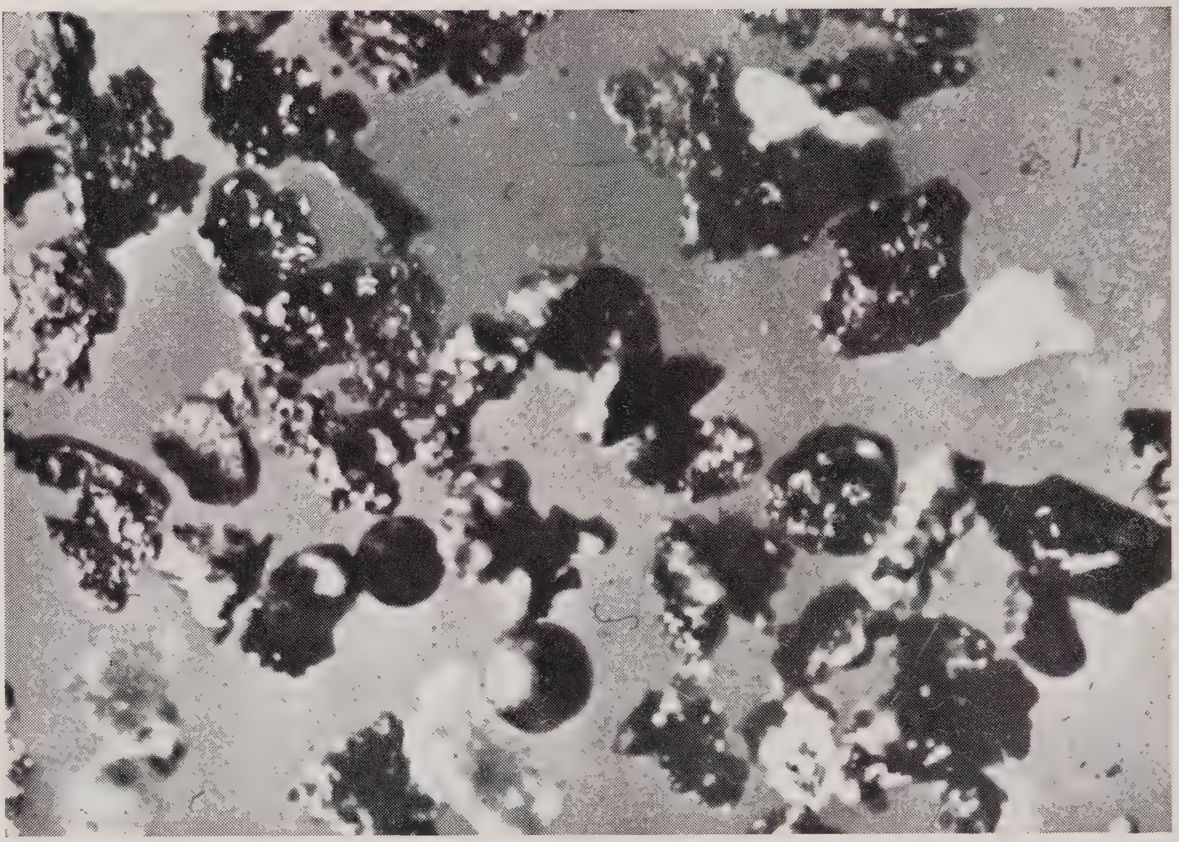

Micro-photograph of flue dust particles from pulverised fuel.

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The Clean Air Act ... 1s. 11d.
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SMOKELESS AIR

Vol XXVIII No. 103 Autumn 1957

Principal Contents

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SMOKELESS AIR is published quarterly by the National Smoke Abatement Society at Palace Chambers, Bridge St., London, S.W.1. Tel : TRAfalgar 6838-9 (Editorial and Advertising). Issued gratis to Members and Representatives of Members. Subscriptions rate for SMOKELESS AIR only, 8s. per annum, post-free.

Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

The Price of Publicity

THE Beaver Committee rightly stressed the need for a more intensive education of the public in the problems of air pollution, and more and more local authorities are now appreciating the importance of publicity of all kinds to help them to secure general support for action under the Clean Air Act, especially in relation to smoke control areas.

Publicity, education, or just plain propaganda, can and should take varied forms, one of the most popular of which is through exhibitions and displays. The growing demand for exhibition materials closely concerns the Society, which, as the only independent organization concerned with providing services exclusively for the clean air campaign, is seeking to assist local authorities by providing effective displays on loan. We have been very much aware, for a long time, of the heavy cost of designing, constructing, maintaining and transporting exhibition units that are both good and durable. The local authorities that are interested are now also finding that although exhibitions may be an excellent means for publicity, they are one of the most expensive.

A clean air exhibition, a shop window display, or even a stand in some more general show, even though it is to last for only a few days, must look attractive and competent if it is to be fully effective. It has to be of a standard that will compare favourably, even though it is more modest, with the expensive advertising displays that the public sees continually. Otherwise it will fail to have the impact that is essential: if it looks cheap, casual or amateurish it may even do more harm than good (and we have seen such displays). The design and construction of the material must be of good professional quality and finish, and this costs money. Starting from scratch, and designing and constructing all its own material, an authority bent on creating a simple but fairly comprehensive clean air exhibition would have to budget for an expenditure of at least £750. A limited purpose display could of course be done on less, but even a single item, making one point only, would for optimum effect leave little change out of a hundred pounds.

It is clearly more economical for the authorities to borrow material for the short periods that it is generally needed, from a central pool, of the kind that the Society is building up. This means a considerable variety of exhibits to meet different needs, and much of it should be at least in duplicate. At present we have only the kernel of the collection that is needed, and it is being used to the full. To make it adequate much more money (and time) than is available is called for. The charges that are made to help towards depreciation and insurance are very reasonable, but some authorities are perturbed about transport costs. There lies another problem: to keep transport costs down by using lightweight units means much more maintenance and more rapid depreciation than if the material is

constructed more sturdily and heavily. As it is, the protective packing for some exhibits costs almost as much as the exhibits themselves.

There are other questions and difficulties that could be discussed, including the rising cost of preparing and supplying posters, leaflets and pamphlets. The Society is anxious to go ahead at full steam, but it cannot do so unless the authorities are prepared either to augment their annual subscriptions quite substantially, or to pay the full economic cost for the material they borrow or buy.

Generally speaking, the amount of money being spent on clean air publicity is quite inadequate for the size of the job to be done, but if it has to be limited then local authorities should consider whether exhibitions are the best way of using it. In certain circumstances there is little doubt that they are valuable, and joint efforts like the West Midlands campaign last winter, or the similar drive in the North-West now beginning, are both more economical and effective than the occasional, sporadic event that is not followed up by some more continuous form of propaganda. To give one example, talks and lectures to local associations and groups may get home more forcibly to the important opinion-forming sectors of the townspeople, at a fraction of the cost of an exhibition, provided that they are sought for and organized.

Nearly In the Red

The Society's accounts for 1956-7, to be presented at Hastings, will show only a narrow margin between income and expenditure. This is largely due to increased expenditure on exhibition activities, and although a deficit has been avoided it does become necessary to ask all members to consider how new income can be obtained if activities—which ought to be expanding fast—are not to be cut. The annual subscription rates are *not* to be increased under the forthcoming new constitution, although we are hoping that the new class of " Sustaining Member " may appeal to some of our present contributors, and perhaps to new ones. (Incidentally, to our regret, there will be no local authorities in the first list of Sustaining Members. It would be encouraging to see even a few.)

The rise in the price of this journal, which begins with this number, does not affect members and representatives, whose copies are in effect paid for out of their subscriptions. The rise is in fact overdue, and is the first since 1946. Printing and overhead costs have advanced considerably since then, and now there is a second increase in postages to be borne.

Lung Cancer

Far be it for this journal to become involved in the anti-cigarette campaign, which is a personal problem and not one of air pollution of the kind with which the Society is concerned. There is, however, one point that must be made: we may be wrong in our impressions, but there does seem to be a tendency, in emphasizing the tobacco factor, consciously or unconsciously to minimize or play down the likely importance of air pollution. For achieving the most telling propaganda against tobacco this may be expedient, but it then becomes less than helpful to the equally important propaganda for the prevention of air pollution. If we are to rely on statistics, some figures suggest that nearly 40 per cent. of lung cancer cases may be " caused " by air pollution, and it is certain that we are hardly at the beginning of knowing the long-term effects on the human body of the complex mixture of particles, fumes, vapours and gases that make up the pollution of the air.

In the U.S. Public Health Report on the environmental causes of lung cancer (reviewed in *Smokeless Air*, Summer, 1956) the author, Dr. W. C. Hueper, sums up his own view by pointing out that the evidence on the cigarette smoking factor is not yet

adequate or medically conclusive and declares that "it would be most injudicious mainly to base the future preventive control of lung cancer hazards on a theory of such doubtful scientific merits and to concentrate the immediate epidemiological and experimental efforts on this apparently over-propagandized concept."

The essential point was seen, during the recent wave of publicity, by a few of the newspapers, and particularly by *The Times*, which concluded a leading article by suggesting that a more direct preventive approach to the problem was of greater urgency than the further statistical surveys proposed by the Medical Research Council. "At the same time," continued *The Times*, "the Government have the duty to take stronger action on the problem of atmospheric pollution. If the cigarette smoker is prepared to deprive himself of the habit from which he derives so much solace, he is entitled to demand that the Government and local authorities show equal interest in his welfare by doing everything possible to clear the atmosphere of our towns from all possible carcinogenic substances."

All-Night Smouldering

Mention is made on another page of the new research findings of B.C.U.R.A. on smoke emission from domestic coal fires. Collecting the smoke by electrostatic precipitation, it has been possible to measure it more accurately than by any of the optical methods used previously, and it is found that the emission may be as high as 5·5 per cent. of the weight of the fuel burned. Also of importance is confirmation of what had generally been surmised—that the amount of smoke, expressed as a percentage of the coal burnt, increases as the burning rate decreases. This means that the all-night coal fire, in which the fuel burns (or smoulders) at a very slow rates, *does* pollute the atmosphere more heavily than when the fire is burning normally.

The North West Clean Air Campaign

The series of exhibitions, supported by meetings and other events, which is being held in the south-east sector of Lancashire and Cheshire during the next few months, will have been opened by the time this issue is published. Similar in conception to last winter's campaign in the West Midlands, the new drive is being sponsored by the North West Division of the Society, and is supported by the Solid Smokeless Fuels Federation, the Gas and Electricity Boards, the D.S.I.R., the Combustion Engineering Association, the oil industry, and others. The organization is very largely being undertaken by the S.S.F.F.

The campaign was due to open at Manchester on 3rd September, with a static exhibition in the Free Trade Hall and mobile displays during the week in the main shopping centre.

The exhibition will be held subsequently as follows:

Sept. 9th-14th: Bolton.
Oct. 7th-12th: Oldham (mobile only).
Oct. 21st-26th: Rochdale.
Nov. 4th-9th: Bury.
Nov. 11th-16th: Stockport.
Nov. 25th-30th: Salford.

In the New Year the exhibition will tour towns in the West Lancashire and Merseyside area. Details will be given in the next issue.

In addition to sponsoring the campaign, through its North West Division, the Society is participating in the static exhibitions with the four display units that were used in the West Midlands. These have been renovated and some desirable improvements made.

Mr. F. J. Redstone

Mr. F. J. Redstone, Chairman of the Executive Council of the N.S.A.S., has recently been elected President of the Western Centre of the Association of Public Health Inspectors.

ANNOUNCING A NEWS BULLETIN

The campaign for clean air is moving faster today, and the Society is receiving more and more requests for up-to-date information. These are for news about the operation of the Clean Air Act, plans for smoke control areas, Parliamentary news, technical intelligence, advice on forthcoming meetings and conferences, and so on.

Smokeless Air records all this information, but, being a quarterly, it clearly cannot pretend to be a vehicle for prompt, up-to-the-minute news. It would be most useful if it were possible to make this journal a monthly, and in time that may come, but at present it is not practicable. It would then have to have some whole-time staff, instead of as now being squeezed in with other duties by the Society's present staff.

It has therefore been decided to issue, in a simple and modest way, an experimental news bulletin to be called, for the time being, " Air Pollution News." This will be a duplicated news-letter type of publication—something that we hope can be " squeezed in " without undue difficulty—which will do no more than aim to give news of importance and interest as quickly as possible. It will be issued as required, and not at fixed intervals, and the length, too, will not be fixed but will depend on circumstances. Some issues, for instance, might contain only one short item of news of importance that it would be desirable to send out without delay.

It should be made quite clear that this venture is, for obvious reasons, purely experimental. It might not work out satisfactorily, or on the other hand it might create a bigger demand than we anticipate, and thus become more of a task than can be readily coped with.

For the trial period, therefore, a large circulation is not being sought. *Air Pollution News* will be sent to members and representatives only if they ask for it *personally*. They will then receive copies as they are issued, without charge, and post free. It will also be sent to non-members on request, if they agree to refund (from time to time) the postages incurred. Later on it may become necessary to make a special subscription charge.

Readers who wish to be put on the special mailing list for *A.P.N.* are invited to write asking for this to be done. It will be assumed that non-members making this request agree to pay postages.

Plants Affected by Smoke

Prevailing South-West winds blow most of London's smoke over Essex, Hertfordshire and the Thames Estuary with the result that vegetation is affected by pollution much more in the East and North areas than in the South and West. This is stated by Dr. Francis Rose, writing in this year's *The London Naturalist*, which has just been published by the London Natural History Society.

He says that mosses which grow on trees are by far the worst affected. One cushion-forming moss of tree trunks and palings is found in the South and South-West as far into the suburban area as Wimbledon Common, Keston and Bexley. In the North and North-East of London it is much scarcer, and rare even at Wormley and Epping.

Nearly 1,500 trees died in Paris last year. The principal cause was attributed to air pollution by fumes and dust. Chestnuts particularly suffer from air pollution. Nearly a half of the city's 84,000 street trees are planes, and recently alder and acacia have been planted because they are considered resistant to pollution.

THE "SCHEDULED PROCESSES" INQUIRY

A Nine Days' Hearing

THE Public Inquiry concerning processes to be scheduled under Section 17 of the Clean Air Act, to which reference was made in our last issue, was opened at Agriculture House, Knightsbridge, with Sir Frederick Armer as Chairman, and Mr. C. W. Damon as Technical Assessor.

The purpose of the inquiry was to hear representations which would assist the Minister in deciding what industrial processes should be scheduled for smoke, etc., control by the Alkali Inspectorate instead of by Local Authorities, as provided for under Section 17.

Representations were made by, or on behalf of, many (if not all) the industrial processes other than steam-raising, for inclusion in the schedule. Opposing these representations, or applications, were the Local Authorities, mainly acting together through the Association of Municipal Corporations.

The proceedings extended over nine days, the final sitting being held on 20th June. The verbatim transcript of the hearings runs to 593 typed and duplicated foolscap pages, so that it will be appreciated that the matter was discussed in some detail.

Each of the trade associations or firms applying for inclusion in the schedule was represented by Counsel, who examined witnesses on each of the processes concerned. These technical experts, prompted as required by questions from Counsel, made full and detailed statements on the processes and their operation, so that in effect the transcript reads like a textbook that contains much useful and interesting information.

With the exception noted later, the local authorities produced no witnesses, and their Counsel did not seek to cross-examine the witnesses on the other side. This position was explained at the end of the examination of the first witness (from the British Iron and Steel Federation), which may be quoted:

Mr. Stirling: On behalf of the Association of Municipal Corporations, I do not propose to ask this witness any questions, although I should make it clear that that does not mean we accept that his evidence establishes a case for inclusion in any Order which the Minister may make.

Mr. Cooke (Counsel for the Federation): I think I must say my Friend must either accept the witness's evidence or cross-examine him.

Mr. Stirling: I know that is what you would like me to do.

Mr. Cooke: Not only would I like you to do it, it is the common and normal, and I should have thought universal, procedure.

Mr. Stirling: If my learned Friend will wait a moment and let me speak he will see the picture as we see it. I think you will have had a letter from the Association of Municipal Corporations written on their behalf by the Town Clerk of Southend.

Mr. Cooke: Have we had it?

Mr. Stirling: Probably not, but that is why I am going to read it now if you will wait a moment, so that we may have here its content. You have had a copy of this letter, Sir, and no doubt it is before you. It says:

> "Dear Madam:
>
> As you are aware, my Assistant Solicitor, Mr. Banwell, is undertaking the preparation of the case for the Association of Municipal Corporations at the Inquiry to be held pursuant to Section 4 of the Public Health (Smoke Abatement) Act, 1926, on 27th May, 1957. I have to inform you that the case on behalf of the Association of Municipal Corporations will be in purely general terms: the matter will not be contested industry by industry upon technical grounds because local authorities do not question the fact that there are

industries which present technical difficulties upon which the advice of experts is necessary. The Association feel that so far as possible the control of smoke should remain a matter of local concern and the effective control should be vested in local authorities.

For the reasons given above the Association will confine itself at the Inquiry to making a statement of general policy and will not be calling any witnesses."

I hope that will make our position perfectly clear. There is perhaps only one exception to this question of calling witnesses, or cross-examining, that if any criticism should be made of the capabilities and the qualifications of local authorities' inspectors, then, Sir, my instructions are that the matter would have to be investigated. I thought it right at this stage to refer to that letter which has been addressed to your Ministry for the benefit of people like my learned Friend who have not seen a copy.

It is quite impossible to attempt to summarize, or even to note the highlights of the evidence which was given so very fully and which took up the first 7½ days of the Inquiry. It was followed by statement made by the Counsel for the A.M.C. and on behalf of the Sheffield and District Joint Clean Air Committee. The A.M.C. case was, by and large, an elaboration of the view expressed in the letter quoted above. A breezy interlude enlivened the proceedings when reference was made to a memorandum that had been submitted by the Association of Public Health Inspectors to the Minister. Objection was raised by the Counsel for the industries to such reference, on the grounds that they had not seen the document, and that as the Association was not giving evidence at the Inquiry its representatives could not be cross-examined. After considerable argument the Chairman ruled that the memorandum could not be admitted.

(This Memorandum, which was published in the July issue of *The Sanitarian*, urged that " the onus of proving the existence of ' special technical difficulties '—which in the Association's view are very few in number—and of clearly defining the precise processes in which these difficulties arise must rest on industry," and that " unless there is a very clear public advantage in specific instances in transferring primary control to the Alkali Inspectorate, local authorities should retain responsibility for the prevention of industrial smoke, grit and dust ".)

A statement by the Assistant Solicitor to the Sheffield Corporation, Mr. T. Holt, followed, on behalf of the Sheffield and District Clean Air Committee, after which Mr. Holt called the Chief Inspector, Mr. J. W. Batey, as a witness to support his case. In brief, the main purpose of this evidence was to show that the smoke control organization and staff in Sheffield and District was capable of dealing with the more difficult processes they encountered, and that, apart from what the Minister might decide for the country generally, an exception could be made for this area, as was possible under section 17(2) of the Act. Mr. Batey was cross-examined at considerable length and with determination by Counsel for the iron and steel interests, who sought to show that even the technically competent Inspectors of the Joint Committee did not possess sufficient detailed knowledge of iron and steel processes that was required.

Then Mr. E. Thomas, representing West Bromwich Borough Council, made a statement on behalf of his authority. Pointing out that they were the first local authority to make a smoke control order under the Clean Air Act, which showed that they were concerned with domestic as well as industrial smoke, he said that taking the widest view of the possibilities, scheduling could involve the transfer of 85 factories and works in his Borough to inspection by the Alkali Inspectorate. He continued:

" As my authority sees it, Sir, the intention of the Beaver Committee was really, very simply, to secure more effective control of some of these processes and, indeed, that is a

view which my authority would support. But I would say this, that it is our view that only in a very few special cases where there really are special technical difficulties should scheduling take place, and we do not for one moment consider that there is any justification for the scheduling of the processes—or hardly any of the processes—carried out in these 85 factories, and that is why I have been instructed to come before you this morning to state our case to you."

At the end of his statement, Mr. Thomas made a point that must be recorded, both because of the thought it expresses and the wit with which it was conveyed:

" In conclusion I only want to say this, that because this country depends to a very large extent on its industrial output there is, perhaps, a tendency to make very considerable allowances for industries' needs. You may, perhaps, recall Dylan Thomas's play 'Under Milk Wood,' where a character called Polly Garter sings a very attractive song, a very saucy song, a somewhat improper song about her past love life, a song which one would expect would not receive the approval of the Minister of Religion who in the play overhears it. On the other hand, Dylan Thomas is very clever, because at the conclusion of the song the Minister simply turns away with a gesture and says: 'Ah well, thank God we are a musical nation!' The implication I think of that must be that much was forgiven in the small village of Llareggyb provided it had musical connections.

" Similarly, Sir, there is this tendency to forgive much in industry provided it is just industrial, and we do hope that you will not conclude your note of these proceedings with the words: 'Thank God we are an industrial nation,' because if you do we in West Bromwich will feel that we have lost."

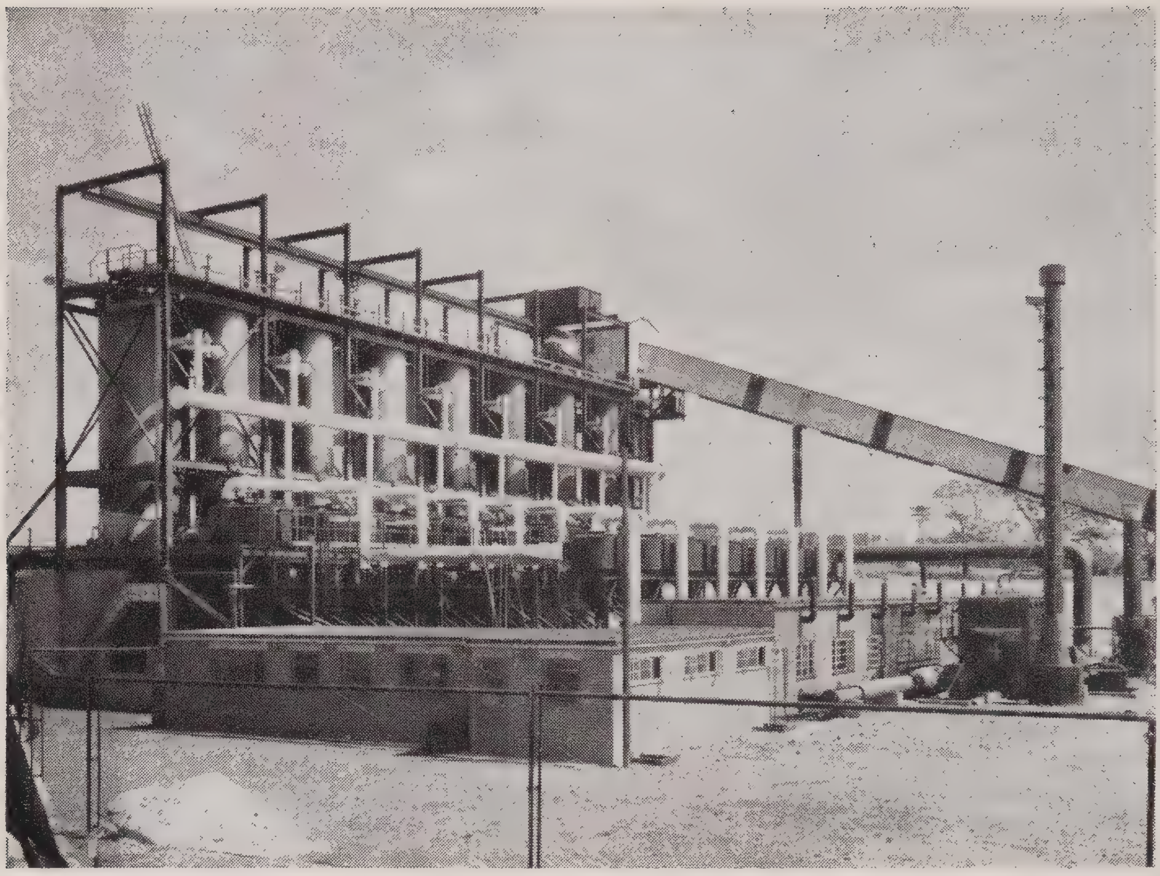
Then, also on the last day, was a statement by Miss Lucy Butcher, representing the National Association of Women's Clubs. She mainly quoted a series of extracts from statements by her members about the effect of smoke and other pollution on their homes and living conditions. These were all very true, very human, and very familiar, but at this inquiry into a difficult administrative problem they seemed a little out of context. It is, however, good to know that still another women's organization is becoming actively conscious about air pollution.

The Inquiry ended with a number of closing statements by the representatives of industry. The Chairman stated that before making his report he proposed, with Mr. Damon, to visit some of the processes that had been discussed.

Electric Heating for Baths

Electric heating is to be installed in West Bromwich Baths, although, initially, it is expected to cost £900 a year more than an oil heating installation. The town council have decided to have electric heating equipment installed at an approximate cost of £13,000, the annual running costs being estimated at between £5,000 and £5,500. The decision in favour of electric heating was taken for several reasons, one of which was that with the continued development of nuclear power, running costs should be reduced in the next five or ten years.

The building is in the council's first smoke control area, and the Baths and Estates Committee recommended that the council should set an example in achieving complete smokelessness. The committee had reported that it had given detailed consideration to the two alternative types of heating. When the matter was last considered about eighteen months ago the cost of oil heating was substantially less than by electricity. Since then the gap had been considerably narrowed so that on present-day costs electric heating would only cost £900 a year more than oil. The Midlands Electricity Board had assured the committee that with the continued development of nuclear power consumer costs should be reduced and that the benefit of development could be expected in 5 to 10 years.



A New "Rexco" Plant

Inaugurated by Mr. Renton

THE photograph above shows the new plant of the National Carbonising Company Ltd., at Thoresby Colliery, Edwinstowe, Nottinghamshire, for the production of "Rexco," the well-known free-burning smokeless fuel.

The plant was formally opened at a ceremony on 19th July by Mr. David Renton, T.D., Q.C., M.P., Parliamentary Secretary to the Minister of Power, for whom he was deputizing, as Lord Mills was prevented from fulfilling his engagement owing to pressure of Government business. Mr. Renton was introduced by Lt.-Col. Vaughan Cowell, to whom the company owes much for the success it has achieved, and who is now its Honorary President.

The first plant for the manufacture of "Rexco" is at Mansfield, an extension of which was recorded in *Smokeless Air*, No. 92 (Winter, 1954), while the process itself was described in a special article in No. 78 (Summer, 1951).

The new plant consists of seven retorts, which are of mild steel plate, lined with fire-brick, 10 feet diameter by 25 feet high. Each has a bottom door with a fire-brick grate, a charging door on top and a side top inlet from an adjoining chamber of similar construction. The bottom door is the full diameter of the retort, and has six flanged wheels, on which it can be moved horizontally on two rails by a power-operated hydraulic ram. Starting with this door closed and sealed with fire-clay, and with a 34 ton charge of coal in the retort, the charge is heated for six hours and then cooled or quenched by drawing cold gas

through it for six hours. The retort is then isolated and the bottom door is opened.

The carbonized coal, which is now "Rexco," falls out of the retort into a receiving wharf below. This has small sliding outlet doors at the base of its sloping sides, and the Rexco is run off through these on to a conveyor belt, after having been sprayed with a minimum amount of water to prevent the re-ignition of the warm, highly-reactive fuel. It is then conveyed to a screening plant and graded into sizes required by domestic consumers—large Rexco for open fires, nuts for boilers and heat storage boilers, and Rexco beans for small central heating installations. From each 34 ton charge of coal about 24 tons of Rexco, 700 gallons of tar oil, and 28 therms of gas are obtained.

All the coal carbonized is best quality Top Hard, and comes in two sizes, namely Washed Large Nuts ($4\frac{1}{2}$ in. by $2\frac{1}{2}$ in.) and Washed Small Nuts ($2\frac{1}{2}$ in. by $1\frac{1}{2}$ in.). This is drawn from the adjoining Thoresby colliery in main line railway wagons. The coal is screened to remove the fines, which are removed by road vehicles for resale. The screened coal passes to a conveyor which runs horizontally along the top of the plant and is fitted with a travelling throw-off carriage or tripper which can be positioned to feed coal to any of the seven retorts. This is done through a telescopic tube or chute, which is lowered into the retort within a few inches of a bed of coke previously placed on the grate of the retort bottom door. The chute is raised slowly as charging proceeds to prevent the coal from being shattered by a long fall.

The gas driven off during carbonization is collected, cleaned, and then used for heating the retorts. A small amount is used to generate steam in a gas-fired boiler, and the remainder passes through a flame trap to the flare stack, where, at present, it burns to waste. Plans for using this gas productively are at present being formulated. The hot tar and liquor from the process are settled and eventually despatched by road to tar distillers.

The installation has been so arranged to allow for a further seven retorts to be erected at a later date, which will bring the total capacity of the plant up to 700 tons of coal a day. With the present plant, and the older one at Mansfield, the Company will now be able to produce nearly 100,000 tons of Rexco a year, as well as 12,000 tons of tar oil and three million therms of gas.

A brochure to commemorate the opening ceremony points out that "the capital cost per ton of annual throughput is lower by a striking margin than that of any other carbonizing plant operating in the world today," and that:

"The Rexco process offers almost the only means of carbonizing non-caking coals. As our resources of good quality coking coals are rapidly being reduced, the demands of heavy industry are progressively becoming more difficult to satisfy, with the inevitable result that the domestic market must look increasingly to the treatment of non-caking coals to meet its needs. The Rexco process is believed to be the only one which, in the prevailing circumstances, would be capable of operating on the output of its primary product alone."

The Minister's Speech

After the opening ceremony and inspection of the plant guests were entertained to luncheon, at which the Chairman of the Company, the Hon. E. D. G. Davies, presided. Speaking after the lunch, Mr. Davies mentioned that they would not be satisfied until the seven further retorts had been constructed, and that this would reduce the capital cost of the plant, expressed in pounds per ton of annual throughput, from fractionally under £3 to about £2 5s. It would also lower operating labour costs by more than a half.

He referred to "areas in this country where quality smokeless coal is either not available or is sold at such a distance from its point of manu-

facture that the resultant price to the consumer deters the demand and it fails to be competitive with local-mined coal. I should like to mention our hope that one day the miners themselves may be able to use smokeless fuel and help to dispel the smoky pall which so often pervades the mining towns and villages. Generally, we are much aware of the need to establish Rexco plants wherever non-coking coal is mined and consumed locally, with the object of bringing cheaper smokeless fuel to consumers everywhere."

The Parliamentary Secretary, speaking after Mr. Davies, combined remarks of his own with reading what the Minister would have said. He admitted that if the gentlemen of the Press were able to dissect the Minister's text from his own commentary they would be jolly good journalists. We think, nevertheless, that the following quotation is from the Minister's speech:

" And, if I may say so, our national habits in the burning of fuel are a national disgrace, because too many of us tend to the belief that the only way to keep the home fires burning is to sit around an old-fashioned type of fireplace with a roaring draught through the room sending most of the warmth that is contained in the coal straight up the chimney to pollute the atmosphere!

" First of all, I think you will agree that we have a moral responsibility to diminish—and if possible to abolish the nuisance, damage and indeed, illness caused by excessive smoke. Under the Clean Air Act, smoke control areas will be created in which the householder must burn not the coal to which he or she has been accustomed all these years, but a smokeless fuel.

" The second aspect of the problem of domestic fuel supplies is the continuous decline, due to modern methods of mining, in the amount of large coal produced. At the moment, we are making good that deficiency by importing large coal into this country at a considerable cost in dollars—and the difference which is paid between the importing cost and the average pithead cost at home is reflected in the subsidy to the domestic consumer.

" Now in my view both these things—namely the need for cleaner air and for utilizing small coal, require a revolution in the consumer habits of the British people. We are still all too prone to regard ourselves as the rich nation we were thirty or forty years ago; we show that weakness in many ways, but in none is it more pronounced than in the way we use our coal resources.

" In my view, it is little short of a scandal that we should use coal, which is our most precious national asset, merely for burning in its raw state when we should be using it as a raw material for processing. But because our habits are so deeply rooted, the breaking of them is a difficult job; much slow and patient work, both of publicity and of persuasion, will be needed. And in carrying out this work of persuasion, the nature of the fuel available—and its price—will play a very important part. It is for this reason in particular that I welcome the opportunity of opening this plant for the National Carbonising Company."

Clean Air Week

During the Chalk Farm Tenants' and Residents' Association's second annual Clean Air Week, more than 100 residents attended a public protest meeting " against the railway smoke and filth that invades our homes." Alderman P. J. Jonas, Chairman of St. Pancras Borough Council's Air Pollution Consultative Committee, assured the meeting that the Council were fighting " this nuisance " and were relying upon the residents of Chalk Farm and their militant Association to back them up to the hilt.

QUESTIONS IN THE HOUSE

Clean Air Council (Membership)

Mr. Blenkinsop, in the House of Commons on 16th July, asked the Minister of Housing and Local Government whether he will include a public health inspector in the Clean Air Council. Mr. H. Brooke replied: " The constitution of the Council has been completed, but I will bear in mind the claims of the public health inspectors when I have occasion to consider any fresh appointments.

Air Pollution (Power Stations)

Mr. P. Noel-Baker asked the Minister of Housing and Local Government what powers under his regulations the Senior Alkali Inspector has to prevent air pollution by electricity power stations. Mr. H. Brooke replied: None at present. The question whether further classes of works, including power stations, should be brought within the scope of the Alkali Act has been the subject of a recent public enquiry, and I will reach a decision in due course. When my noble Friend the Minister of Power gives his consent to the construction of a new power station or the extension of an existing one, he normally requires the use of the most efficient methods reasonably practicable for the elimination of smoke and grit.

Air Pollution Officers

Mr. P. Noel-Baker asked the Minister of Housing and Local Government how many authorities are unable to obtain qualified persons to carry out the functions of air pollution officers. Mr. H. Brooke replied: " There is a shortage of public health inspectors, who normally undertake air pollution duties, but I understand that there was a marked rise in recruitment last year. I regret that I cannot say how many authorities have vacancies unfilled at the present time."

A.P. AND LUNG CANCER

Statistics for Women Patients

A number of references to work on the significance of air pollution in the aetiology of cancer of the lung are made in the 34th Annual Report (for 1956) of the British Empire Cancer Campaign. Various research reports included in this 559 page volume refer to the search for carcinogens in chimney smoke, petrol and diesel exhaust fumes, to attempts to demonstrate their carcinogenity in animals, and also by studies contrasting the lung cancer death rate in urban and rural areas.

This last is of considerable interest, for it deals with investigations into smoking habits of women lung cancer patients living in town and country areas of North Wales, Cheshire and Lancashire. The preliminary results published support the previous finding for men: that both smoking and urbanization are related independently with lung cancer mortality. (Stocks and Campbell, 1955). A table shows three main facts:

(1) In each division of differing urbanization (rural, mixed and urban) the lung cancer death rate was higher among women smokers than among those who had never smoked.

(2) The rate among non-smokers were two to three times as great in the Lancashire part of Merseyside as in North Wales and the Cheshire and Wrexham areas, and about 40 per cent. higher than in the parts of Lancashire outside the conurbation.

(3) The rates among smokers also showed a pronounced gradient with increasing urbanization.

This preliminary study of the data relating to lung cancer in women is to be followed by a more detailed report shortly by Dr. Percy Stocks.

Oxford in Decay

An Appeal and its Moral

THE erosion of famous buildings through the action of air pollutants, even in places where such attack might be least expected, will be familiar to all who have studied the literature on air pollution. Too often, also, is the diagnosis made only when it becomes necessary to appeal for funds, not to reduce the pollution, but to repair the damage it has so far caused. An excellent, even classical, example of this now arises with the Oxford Historic Buildings Appeal.

We commend this to the attention of our readers for two reasons. First, because it is an appeal well worth helping, and secondly because to those concerned with clean air it is a notable instance of what has been called British daedalism. By this word is meant a labyrinthic circling around a problem instead of a direct, logical approach. Daedalism, it would seem, thrives as much in the philosophical climate of Oxford as elsewhere.

It must be emphasized that we are not criticizing or disparaging the appeal itself, which is most necessary and is being promoted in a way that commands both sympathy and respect. Our illustrations show something of the shocking conditions of two of Oxford's famous buildings, and other equally appalling examples are given in the appeal booklet. Altogether £2,090,000 is being asked for, of

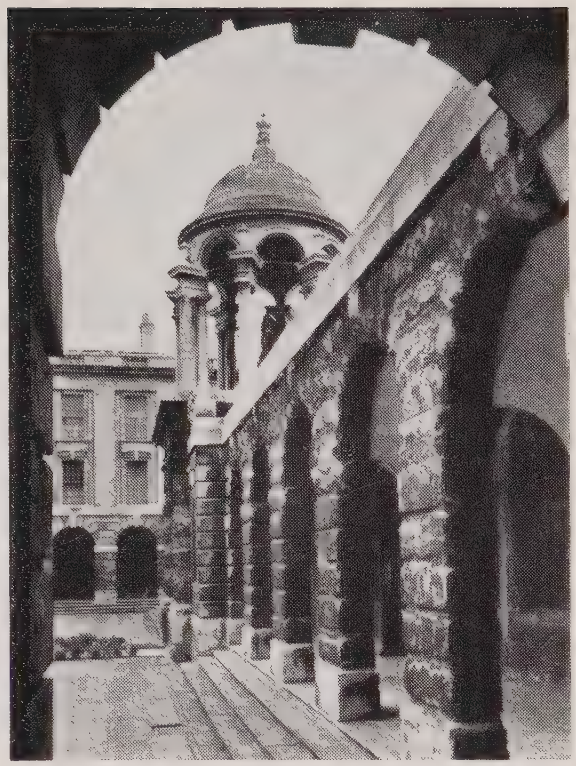
which £430,000 is needed by the University for its own buildings—the Sheldonian, the Bodleian Library, St. Mary's Church, the Radcliffe Camera, and other buildings—while £1,470,000 is to go to the individual colleges. Christ Church alone calls for £600,000. To the estimated repair bill is added a further £190,000 for architects' fees, bringing the grand total to over the two millions.

The appeal booklet explains why the buildings are crumbling away so dramatically. There is, of course, the natural corrosion due to wind, driving hail and rain. Vibration from traffic may be a factor, and damage is done by iron cramps, fashionable during the 19th century, which rust and swell, fracturing the stone they are supposed to bind.

" *But by far the commonest type of decay*," continues the booklet, " *in Oxford is 'blistering' by chemical action. Sulphur dioxide from the air reacts with the stone to form a 'skin' of calcium sulphate. This expands and contracts with changes of climate in a way different from that of the stone, and so leaves the surface to form a blister which finally falls off.*"

This action applies particularly to the Headington freestone which has been used in many of the buildings. Those who are interested in the chemical and physical actions which occur will find a more detailed account in the Building Research Report, *The Weathering of Natural Building Stone*, by R. J. Schaffer. For those who may be inclined to think that sulphur dioxide alone is the culprit, it may be pointed out that this report stresses the fact that " pollution by solid products of combustion is also important because soot causes disfiguration, and also because soot carries with it acid materials which it brings into close contact with the stone."

It is most interesting to find that air pollution is regarded as by far the commonest agent responsible for Oxford's decay. And this is in a city that only recently has become industrialized and is still surrounded by an open countryside. Except perhaps by those to whom the testament of beauty has no meaning, it will be agreed that the appeal must succeed and that the ravaged stone must be replaced or repaired and made as new. It will cost £2 million. which is a large sum to raise, but is a trifling amount compared with the value of Oxford's splendid fabric.



Above: Arcade at Queen's College. Opposite: Facade of the Library, Christ Church

But—and this is where we become awkward—what an appalling waste it all may be if a great deal more is not done, with equal urgency, to halt the decay that is still going on, and to prevent even the restorations being attacked in their turn. Oxford, of all places, should be a smokeless city, and it would be absurd if every effort were not made to make it such while the £2 million is being spent. It would be like applying artificial respiration to a half-drowned man without first taking him out of the water.

Is this simple point understood in Oxford? We doubt it. There is no reference to such a need in the appeal booklet, and although the City Council

is making plans for smoke control areas and other steps to implement the Clean Air Act, we do not know of any backing being given to them by the University, which should in fact be clamouring for action. The Pilgrim Trust has made a most generous contribution to the fund, but we are not aware that it has ever spared a penny for purposes that would help to make such donations unnecessary. This is what we mean by daedalism.

One section of the appeal booklet is headed " Wisdom hath builded her an House." The universities generally, being the houses of wisdom, should surely be foremost in the struggle for clean air, and be taking a distinguished lead in the creation of the public opinion that is needed, even if it is only for the sake of their own sulphated stones or—as the case may be—their darkening red brick.

COALITE PROGRESS

The Report and Accounts, for 1956, of Coalite and Chemical Products Ltd., show further good progress in the development of the oldest and best-known of the named smokeless fuels. The accounts show that the profit, after depreciation and before charging taxation, totalled £670,389, compared with £563,158 the previous year. The net profit has increased by £46,567 to £333,333, and £200,000 has been transferred to general reserve. A tabulated statement showing the progress of the " Coalite " group over the past seven years makes remarkably satisfactory reading for the company and its shareholders—and indeed, for the clean air movement itself, in which " Coalite " will have an increasingly important function as smoke control areas multiply.

The Chairman, Commander Colin Buist, in his Statement, says: " It cannot be stated too often that ' Coalite ' is suitable for burning in all types of open fires and closed stoves, whether they are ancient or modern. It is our policy to make a fuel fit the grate and not expect our customers to buy a grate to fit the fuel. It should also be emphasized that the Clean Air Act is not designed to abolish the cheerful and health-giving open fire which over the years has been the focal point of our home life. An open fire in the main living room is in the finest tradition of the British character and part of our heritage. Long may it remain so."

The Chairman also mentioned that to meet the needs of the Clean Air Act they now have eight resident representatives in strategic parts of the country, in addition to the members of the Sales staff who operate from head office and London.

Housewives suffer from Air Pollution

Dealing with the effects of atmospheric pollution on family life, Miss J. M. Akester, Superintendent Public Health Visitor, Leeds, at a meeting of the West Riding Clean Air Advisory Council, expressed the view that it was the housewife who suffered most and she was the one on whom the family depended for protection from its effects. " For the city housewife life very easily becomes one long round of scrubbing, washing, cleaning, polishing and scrubbing. The higher her standard the more arduous her task," she said. A woman had to be very tough and hardy to stand up to the battle for cleanliness and to keep her looks in the middle of an industrial area.

Miss Akester said that for those who had to deal with problem families, air pollution could complicate matters. It was tragic that the only inheritance of some of those city women was just dirt and drudgery. Clean air would relieve them of one of their greatest sources of fatigue, expense and anxiety.

New Books and Reports

The Law on the Pollution of the Air and the Practice of its Prevention. By J. F. Garner and R. S. Offord. Pp. 208. Shaw and Sons Ltd. 30s.

This is the first legal reference book on the Clean Air Act to be published, on which the authors, who are the Town Clerk and the Borough Surveyor of Andover, are to be congratulated. At first sight Andover seems an unexpected source for a textbook on air pollution, but the authors, singly or together, are responsible for a number of works on local authority law and administration, and this volume shows that they are practised hands and able to explain with lucidity the many technicalities, both legal and industrial, with which the Clean Air Act bristles.

The book is in three sections: the Act itself, annotated in detail; some technical notes; and verbatim copies of the Ministerial orders and memoranda that had been published at the time of printing. There are also brief accounts of the Public Health Act, 1936, and the Alkali, etc. Works Act. The annotation is most useful, especially for its references to earlier legislation and definitions. A general survey of the development of the legislation, including references to local Acts and especially those that paved the way for the Clean Air Act during the past decade, would have been of value. London and Scotland in particular receive little attention, while a page or two on the still important possibilities of action under Common Law would have helped to make the work more comprehensive.

The Technical Notes, dealing with smoke, atmospheric pollution generally, fuels, furnaces, chimneys, and the processes covered by the Alkali Act, though necessarily condensed, are to the point and will be frequently useful to many public health officers. The early publication of such a handbook has its advantages, but it has to face the danger of not being completely up-to-date. It was printed too soon for reference to be made to the Smoke Control Areas (Exempted Fireplaces) Order, 1957, and the circular (27/57) issued with it, and of course, there will soon be an important new series of regulations and orders on the sections to come into force in a few months' time. A new edition will then be called for, and we hope it will be forthcoming.

Particulate Clouds, Dusts, Smokes and Mists. By H. L. Green and W. R. Lane, with a foreword by Sir Harold Hartley. Pp. 425, plus plates. E. & F. N. Spon. 70s.

This text-book is comprehensive as its title suggests. It is divided into two parts: the basic physics and physical chemistry of particulate clouds, individual suspended particles in gases, etc., and their industrial and environmental aspects. The first part is purely scientific, dealing with the production of particulate clouds, their physical characteristics and optical properties. This leads to chapters on coagulation, deposition and filtration, sampling and estimation, and then to the questions of diffusion in the atmosphere.

The second and somewhat shorter part of the book examines, in full but without going into technical details of plant and processes, the industrial and environmental aspects of particulate clouds, dusts and smokes, including a succinct chapter on atmospheric pollution. The collection of particles in industrial practice is surveyed, and there is also a chapter on health hazards. This deals not only with dusts of various kinds, their sampling and individual protection from them, but also with radioactive and microbiological aerosols, tobacco smoke, and fire and explosion hazards. Aero-

sols in nature are discussed, and an interesting final chapter is concerned with the uses of particulate clouds, as in industry, for therapeutic purposes, in agriculture and pest control, and for screening and signal purposes.

Thus both theory and practical aspects are surveyed over a very broad field, and are covered, it may be said, with obvious authority. As Sir Harold Hartley says in his foreword, the book will certainly be regarded as the standard work on the subject. The comprehensive references given at the end of each chapter are one indication of the way in which the authors have brought together the results of a vast amount of knowledge and direct experience in the field.

Electro-Precipitation, by R. F. Heinrich and J. R. Anderson.

This fifty page booklet is a reprint from *Chemical Engineering Practice* (Vol. 3) published by Butterworths Scientific Publications. The authors are members of the staff of Simon-Carves Ltd., Cheadle Heath, Stockport, to whom inquiries should be made for copies of the reprint.

It is a most informative review of the principles and practice of electro-precipitation and its applications for different purposes. Intended mainly for the technologist, it will nevertheless provide much essential information for local authority administrators and others.

Structural Insulation, by C. L. Haddon. Reprinted from the "Industrial Heating Engineer." John D. Troup Ltd. 7s. 6d.

With a welcome, if belated, growth of understanding of the importance of thermal insulation, which is being given an important push forward by Mr. Nabarro's Thermal Insulation Act, there has been an urgent need for a balanced and practical publication giving the essential information on the subject. This has now been supplied in the form of a reprint of a series of articles that appeared in *The Industrial Heating Engineer*. Five illustrated articles are included in the volume: the fundamentals of thermal insulation; the properties of insulating materials; their selection; the economics of thermal insulation; and finally a short article on the practical application of insulating materials—*i.e.*, the methods of using and fixing them.

The importance of thermal insulation to the clean air movement hardly needs stressing: the better insulated buildings are, the less the fuel needed to warm them. Less fuel means less likelihood of smoke through overloading as well as less effluent, whether smoky or not, passing into the atmosphere.

The Design of Water Heating Systems in New Houses, with special reference to electric heating. This is a 16-page booklet published by the British Electrical Development Association, which explains the general principles on which efficient water heating in the home must be designed, before dealing with the use of electricity in applying them. Informative and practical.

Oil Fuel Applications, by A. T. Henly. Pp. 250. Crosby Lockwood and Son Ltd. 35s.

Oil, in its various forms, is of increasing importance to the clean air movement, for it can play a substantial part in the changes in fuel usage that must be made if the Clean Air Act is to be fully implemented. Kerosene (or paraffin), being used increasingly in the home, thanks to the attractive and efficient new types of heater and to supply facilities, is for all practical purposes a smokeless fuel, and although the heavier oils cannot very well be classified as authorized fuels in smoke control areas, it is only when they are burned wrongly that they produce smoke. The problem of how to obtain enough solid smokeless fuel will be less difficult to solve if some

of the burden can be shouldered by oil.

Those concerned with the administration of the Clean Air Act will find it increasingly helpful to be able to refer quickly to technical information about oil and its uses, which for one reason or another has never seemed to be as easy to obtain as is information on solid fuels. This new textbook by A. T. Henly, who is a consulting engineer, will go a long way towards meeting this need. It is a practical and technical handbook, which seems to be pretty comprehensive without becoming too detailed. It deals with all types of oil burners and ancillary equipment, including automatic controls and instruments, and with standards for oil fuels and oil-firing installations. There are useful chapters on miscellaneous applications and on " maintenance and trouble tracing." An appendix of data relative to oil-firing problems is also included, together with a bibliography and a good index.

The book was written before the Clean Air Act reached the statute book, but contains a number of references to the Beaver Report, and there are some practical notes on the Ringelmann smoke chart and its use in recording smoke and calculating average smoke densities over a given period. There is, however, an error or misprint at the foot of page 231, where it is stated that " legislation is tending to prohibit smoke of greater density than Ringelmann 4." The figure should, of course, be 2.

Foundry Air Pollution Control Manual. Published by the American Foundrymen's Society Inc., and obtainable in Great Britain from the Penton Publishing Co. Ltd., 2 Caxton Street, London, S.W.1. 57s., including postage.

This manual will be helpful to all concerned with air pollution problems arising from foundry operation. The fact that it is American, and therefore deals with practice in that country, may be of more advantage than otherwise, as it may well suggest techniques and methods that can be used and adapted to meet British needs.

It surveys the sources of pollution in all sections of the foundry industry, and contains a chapter on " community relations," which deals with court cases for pollution nuisances and the consequences of the rising public concern about the state of the atmosphere, together with a review of existing ordinances and codes in the U.S.A. Though primarily of interest to foundry technologists the manual should be helpful to local authorities in whose areas this particular source of pollution is found.

The Application of the Clean Air Act to Private Dwellings and Industry. Published by the Combustion Engineering Association (jointly with the Solid Smokeless Fuels Federation.)

This is the report, duplicated and bound, of the conference in Birmingham on 16th and 17th April, 1957, at the end of the West Midlands Clean Air Campaign. It does not, however, contain the paper on the application of the Act to private dwellings, which was recorded in the last issue of this journal. There are a number of short addresses by Mr. Denis Howell, M.P., Alderman G. Corbyn Barrow, Mr. Lester Horne and Sir Henry Jones, but the important part of the report is a more solid paper by Mr. G. Nonhebel, on " The Engineer's Part in Implementing the Clean Air Act."

One extract from Mr. Nonhebel's paper may be quoted in full:

" There were four major lines of attack on the pollution problem all of which should be fully explored if the most rapid advance was to be made.

" 1. *Improve the method of operating particular processes in order to reduce the formation of noxious effluents.* There was no need to elaborate on the direct as well as the indirect benefits of improving operational efficiency. However good a plant may be, there

was nearly always scope for advance and this generally led to economic gain in addition to reduction of pollution. The excellent work now being carried out by N.I.F.E.S. showed what improved results could be obtained in this way.

" 2. *Install or improve equipment for removing as far as possible the pollutants at the end of the process.* Typical examples were the use of cyclones and electro-static precipitators for the removal of dust, electro-static precipitators and Venturi scrubbers for the removal of certain classes of fume and scrubbers for the removal of fluorides.

" 3. *Change the process itself.* As a simple example we had the change from hand-firing to mechanical firing of boilers. As a more complicated example, we had the change from the bottle kiln in the pottery industry to the gas- or electrically-heated tunnel kiln. This latter change had given a good, in fact a substantial, financial return. So here, it could be said that abatement of smoke had paid dividends. In the chemical industry itself there were frequently complete changes of processes which could alter the effluents discharged, both gaseous and liquid. To change complicated processes meant work by highly qualified technologists to carry out the research, development and careful design which were essential.

" 4. *Increase the height of discharge of effluents.* In theory this was possibly the most obvious and the simplest method of minimizing the immediate results of pollution, but it could not be a complete cure. We lived on a small island and the discharges from one industrial area were bound to be carried by the wind to other parts of the country. Nevertheless, the only known practicable method of reducing the harmful effects of the SO_2 formed by combustion of coal or oil without incurring serious technical complications, was to discharge products of combustion through high chimneys."

THE THERMAL INSULATION ACT

The Bill, promoted by Mr. Gerald Nabarro, M.P., to require effective heat insulation in all new industrial premises (see *Smokeless Air*, spring, 1957, p. 174) received the Royal Assent on 17th July, and became the Thermal Insulation (Industrial Buildings) Act, 1957.

The Act consists of thirteen sections. It first empowers the Minister of Power by regulations to prescribe standards of insulation against the loss of heat from industrial buildings. An industrial building is defined as a factory, or part of a factory, within the meaning of the Factories Acts, 1937 and 1948.

When plans for a proposed industrial building are laid before a local authority they are to be rejected unless it is shown that they conform to the prescribed standard of insulation.

The Act gives the Minister power to make regulations for restricting the use of certain materials—materials, that is, which do not conform to a standard to be prescribed " of resistance to the spread of flame."

Local authorities are given power to require the removal or alteration of a building that does not conform to the prescribed standard, or conforms to it in the wrong way (with reference to the case of the " restricted materials " previously mentioned).

A further section is concerned with procedure for referring to the Minister any questions that may arise between a local authority and a person who proposes to erect an industrial building, and gives the Minister power to make a final decision.

Apart from exemptions that either the Minister or a local authority (with the Minister's approval) may make, these regulations are to apply to new buildings, or extensions of buildings, the erection of which is begun after 1st January, 1959 (or earlier date if the Minister should make an order).

The Act applies to Scotland, but not to Northern Ireland.

The N.C.B.'s Report

Smokeless Fuels and Fuel Efficiency

THE Report of the National Coal Board for 1956 could with great advantage be read by those many laymen who so casually criticize the Board and the miners for the nation's fuel difficulties. They would then appreciate rather more clearly the extraordinary complexity of the problems the Board is having to tackle, and the time, or money, or both, that many of them need before they can be solved. There are no doubt many things for which the Board can be criticized, but they should be seen in the perspective of the vast field of activities that is given by a study of the report.

Here we can only refer to those things which concern clean air progress. It is first of all important to note the extent of the Board's programme on coke oven development, as seen from a table which shows that during the period 1947 to 1958 capital expenditure on new or enlarged coke oven plant will be £38 million. This includes £10·5 million for the Avenue plant in the East Midlands Division, an account of which was given last year in *Smokeless Air*. This is the largest constructional contract ever given by the Board, the second largest being the extended coking plant at Manvers Main, in the North East Division, which came into production in 1956. The cost of this was £8·7 million, and its coke output of 700,000 tons a year is being partly used for steel making and partly for domestic and industrial use. In 1956 the Board disposed of 6,360 million tons of coke, of which 2,578 million tons went for domestic and industrial purposes.

Research

On the other type of smokeless fuel made by the Board, the report says:

" One of the ways in which the Board can help to limit atmospheric pollution is to develop methods for making new fuels which will burn smokelessly. The Board's Coal Research Establishment at Stoke Orchard near Cheltenham, conducts research into the manufacture of new fuels and, during 1956, much of the work of the Establishment was directed to research on processes for making domestic smokeless fuels, both for open grates and for closed appliances.

" There are only limited reserves of the coal from which smokeless fuels such as " Phurnacite " can be made by existing processes. One aim of the Board's research has therefore been to adapt these processes for use with coal for which they could not formerly be used. Others have been to devise new processes to use the small sizes of high volatile coal which are likely to be more freely available in the future, and to find new ways of producing high grade smokeless fuel for use in the open fire.

" In general good progress has been made. For example, until recently it was impossible to make uncarbonized briquettes out of small coal without using either inordinately high pressures or a pitch binder, which is expensive and produces a lot of smoke. A process was invented at the C.R.E. by which briquettes can be made successfully without a binder and this has been named the ' Shape ' process. Since no binder is used, briquettes made in this way from small, smokeless coals will be smokeless, and coals of this type have so far been used during development work. The fuel burns well in an open grate."

This is only one example of the work of the C.R.E., and the report emphasizes that the nature of this research demands the investigation of many possibilities and of many related processes, such as new methods

of carbonization and improved methods of cleaning fine coal.

Fuel Efficiency

Among many other subjects of clean air interest in the report are coal cleaning (at the end of 1956 nearly 60 per cent. of coal reaching the market was being mechanically cleaned), underground gasification, and fuel efficiency. After commenting on fuel efficiency generally, and what is being done to burn coal more economically in industry, the report discusses the Board's own fuel efficiency problem. As this will be of particular interest to readers in the mining areas it may be quoted at some length:

"The collieries themselves use a great deal of fuel. At the vesting date, much of the fuel-burning equipment which the Board took over at the collieries was worn out and inefficient; not nearly enough instruments for checking the operation of the plant were available; and the men who operated the plant had seldom been trained to burn coal efficiently. There was a real task to be done.

"Complete electrification will usually give the most efficient and economical service and the Board are in process of electrifying those collieries which are expected to continue in operation for a long period. By the end of 1956, 462 collieries were completely electrified.

"There will remain, however, a number of collieries which will continue to have their own boiler plant. At these, the Board are aiming to increase fuel efficiency by fitting mechanical firing equipment, by ensuring that the highest standards of stoking and instrumentation are maintained, and, more important still, by developing and installing mechanical stokers designed to burn slurry effectively. A boiler fitted with such a stoker, installed at a colliery in North Wales, has successfully burned raw pond slurry and fine coal with combustible matter of less than 40 per cent. Arrangements are being made for similar installations at other collieries to extend the use of slurries.

"The Board have their own fuel efficiency service and, since 1951, a mobile team has been at work at collieries. Training courses for stokers and boilermen have been run in all Divisions; and in areas where there are still a large number of steam plants, engineers have been appointed with special responsibility for securing efficiency. Progress has been good. In 1951, coal, gas and electricity equivalent to 58 tons of coal were used at collieries for every thousand tons of saleable coal produced; in 1955, the equivalent of less than 52 tons was used. The actual tonnage of saleable coal used at collieries fell from 11·1 million tons in 1947 to 7·9 million tons in 1956."

The Coal Utilization Council has recently brought out two publications of value to all who may be considering the acquisition of a solid fuel appliance, or who may be called upon to advise others in a similar case. The first is a booklet entitled "Choosing the Right Appliance," and is intended for use in conjunction with the list of recommended appliances published jointly by the C.U.C. and the Solid Smokeless Fuels Federation. It describes, with ample illustrations, the characteristics of the various types of appliance, and the factors to be taken into consideration in the selection of them.

The second publication is a book by Mr. W. C. Moss, Technical Manager of the C.U.C., with the title "Correct Fixing of Domestic Solid Fuel Appliances." That it goes into the subject in considerable detail can be seen from the fact that it runs to 80 quarto pages. It is also well illustrated with diagrams.

The booklet on choosing the right appliance is gratis, while the book on fixing is priced at a very reasonable 1s. 6d. Both are obtainable from the Coal Utilization Council, 3 Upper Belgrave Street, London, S.W.1.

The Scientific Study of Air Pollution London Course

A course with the above title, of eleven weekly lectures and one discussion evening, has been arranged for the coming winter by the Department of Extra-Mural Studies, University of London. The meetings will be held in the Huxley Building, Imperial College (opposite the Science Museum), from 6.45 to 8.45 p.m. on Thursdays, beginning on 26th September and ending 12th December.

The subjects to be discussed and their authors, are as follows:

Survey of the Pollution Problem, by Dr. W. C. Turner, M.O.H., Poplar.

Structure and Motion of the Atmosphere; Theory of Meteorological Control; Behaviour of Turbulent Smoke Plumes; by Dr. R. S. Scorer, Lecturer in Meteorology, Imperial College.

Effect of Pollution on the Heat Balance of the Atmosphere, by Professor P. A. Sheppard, Professor of Meteorology. Imperial College.

Bronchitis; Other Diseases of Pollution, by Dr. Horace Joules, Central Middlesex Hospital.

Physical Chemistry of Fog, by Dr. G. A. H. Elton, Reader in Applied Physical Chemistry, Battersea Polytechnic.

Field Research (2 lectures), by D. H. Lucas, Central Electricity Authority.

Legislating for Clean Air, by Arnold Marsh, National Smoke Abatement Society.

The penultimate meeting will be a general discussion, with Professor Sheppard in the chair, on " Research and Action in Relation to the Problem of Atmospheric Pollution."

The fee for the full course will be £1. Admission to single lectures, 2s.

Bradford Tenants Prefer Smokeless Fuel

The Mayor of Burnley (Miss A. Procter), together with twelve Corporation members and officials, recently made a tour of Bradford's smokeless zone areas, comprising 1,500 acres already smokeless and a further 600 acres soon to be dealt with. Councillor J. Cassidy, Chairman of Burnley Housing Committee, said the visitors were impressed by the fact that any bias of the tenants against smokeless fuels had completely disappeared. They had interviewed a number of tenants who had had suspicions about the use of smokeless fuels before they went to their new houses but who would not now go back to coal under any circumstances.

Two of the tenants claimed that curtains had been hanging for long periods without needing washing. One tenant considered that smokeless fuel led to a big saving in cleaning materials and gave carpets and curtains longer life because there was little dirt from grates and the outside atmosphere. The visitors were also impressed by the clear atmosphere on the 1,600 house Thorpe Edge Estate. Although Burnley Corporation has built 2,000 Corporation houses since the war, they have as yet no smokeless zones.

News from the Divisions

Scotland

The Scottish Division, under the Presidency of Mr. John Innes, held its annual general meeting and two-day conference in Dundee on 23rd and 24th May last. The conference was well attended and in the scope of its papers and the liveliness of the discussions it was perhaps the most successful yet held. One of the papers, by Mr. James Strachan, is reported extensively elsewhere in this issue, and in addition there were papers of interest on "The Implementation of the Clean Air Act by a local authority member (Dr. Robert Ritchie of Perth) and by an officer (Mr. John Page, Chief Sanitary Inspector, Kirkcaldy). At the closing session, on the Friday forenoon, the concluding address was by Professor Alexander Mair, of the Department of Public Health and Social Medicine, Queen's College, Dundee, on "The Health Hazards of Atmospheric Pollution." In addition to discussing the more familiar health aspects of the problem, Professor Mair reviewed the situation arising from the radiation and fall-out from nuclear explosions. At each session the questions and discussions were such that time did not allow all potential speakers to join in.

On the Thursday afternoon visits were made to the Dundee Gas Works, where special attention was given to the grading of coke from Fifeshire coal distilled in continuous vertical retorts, and to the boiler plant of the Carolina Port Power Station—a coal-burning station of the North of Scotland Hydro-electric Board. Then followed visits to the works of William Briggs and Sons Ltd.—tar distillation, asphalt manufacture and a roofing felt works. Crude tar is pumped direct from the Dundee Gas Works, a mile away, to the tar distillation works.

The conference ended on the Friday with a luncheon at which the Lord Provost of Dundee, and his Lady, were the principal guests.

East Midlands

The annual general meeting of the Division was held at Chesterfield on 10th July, 1957. The meeting was held in the Town Hall and the delegates were welcomed by the Deputy Mayor (Alderman W. Weston, J.P.) The Chairman (Councillor Mrs. Ellen E. Bostock) expressed the thanks of the Society to His Worship the Mayor for attending the meeting and giving a welcome.

During the course of the meeting a discussion took place on the Special Conference on grit and dust which was held at Derby on 26th June. It was moved by Councillor Rev. Brooke Westcott and seconded by Dr. S. Childs, M.O.H., Scunthorpe, that the National Executive Council be requested to organize nationally a meeting to discuss the subject of grit and dust emissions from the iron and steel industry. The resolution was carried.

The following officers were then appointed unanimously for the year 1957-58: Chairman, Mr. G. E. Chamberlain; Deputy Chairman, Alderman E. Purser; Hon. Secretary, Mr. A. Wade; Hon. Auditor, Mr. H. N. Eardley; Scrutineers, Mr. V. Wales and Councillor Rev. A. Brooke Westcott.

After the formal business of the meeting an address was given by Mr. G. W. J. Bradley, General Manager of the Carbonization and Briquetting Department of the National Coal Board's East Midlands Division. In the course of his address Mr. Bradley described the Avenue Carbonization and Chemical Plant and its products, using a plan and a scale model of the works. After

Lunch at Dundee: Mr. Innes addresses Lord Provost William Hughes, C.B.E., J.P.

lunch the delegates assembled at Wingerworth and were conducted over the Avenue plant by the General Manager and his staff.

Yorkshire

A meeting of the Division was held at the Civic Hall, Leeds, on 3rd June, 1957. The Chairman (Mr. A. C. Saword) opened the meeting by introducing Mr. D. G. Wilson, Coke Officer of the North Eastern Gas Board who, he said, would address the meeting on " Coke and Clean Air " after the showing of a short film entitled " Gas Coke Production in Intermittent Vertical Retorts."

Mr. Wilson commenced by outlining the present legislation regarding dark smoke and fuel, under the Clean Air Act. He proceeded to describe briefly the alternative types of modern appliances for burning solid fuel, all of which, he suggested, were efficient if used in their proper situation. He then mentioned the much publicized super-reactive cokes which were usually made from non-traditional coals. The disadvantages of this type of fuel were several—no guarantee of supply of the special coals for manufacturing the coke—approximately 85 tons a day were being made at the present time, and if the production increased to any extent, the price of the raw coal might rise.

Mr. Wilson emphasized that in the district covered by his Board only Yorkshire coals were used, thus saving transport costs, and that coke was now produced for its own sake and carefully graded for all uses. It had been standard practice for some time now to take samples of No. 2 coke and put it through an open fire test. Mr. Wilson concluded his address by dealing with distribution and costs and said that it must be remembered that they had to purchase two tons of coal to produce one ton of coke and the cost of handling and processing had steadily increased over the last few years. Previous shortages of coke were not entirely attributable to the gas industry but, he suggested, were

almost entirely a symptom of shortage of all fuel.

Councillor Hall of Normanton asked about the fumes from coke burnt in open fires. Mr. Wilson suggested that if the fumes were noticeable it was due to some fault in the appliance or the way it was fixed. Mr. Steele of Bradford Civic Society, complained of the explosive nature of some coke. Mr. Wilson said that this was due to the inferior coal obtained from some collieries, but would only be found in the No. 1 or in the small size coke, not the No. 2 which was the most suitable for use in domestic open fires.

Councillor Hall mentioned the question of concessionary coal for miners, and was informed that this matter had been successfully settled in one area by an adjustment in cash. Several delegates raised the question of competition between the Gas and Electricity Boards and suggested that some sort of amalgamation or co-operation was needed. Mr. Wilson said that each undertaking had its own part to play and in his opinion that was the most efficient way. Several speakers also asked about the moisture content of coke and its variation. Mr. Wilson informed the meeting that investigations were being made into the proper storage of coke, particularly as regards the gaining or losing of moisture content.

Another meeting of the Yorkshire Division was held at the Yorkshire Main Colliery, New Edlington, on 15th July. After the business meeting the Chairman introduced Dr. T. D. Spencer, Divisional Medical Officer of the North Eastern Division of the National Coal Board, who gave a talk on "The Effect of Exhaust Gases from Internal Combustion Engines on Health." Dr. Spencer discussed the various toxic substances, chiefly gases, which may be found in these exhausts. Speaking of the carcinogen 3:4 benzpyrene, he said that this substance could only be found in diesel smoke where the engine was being maltreated or was very badly worn. In the North Eastern Division of the N.C.B. the Scientific Department had been carrying out tests in conjunction with Leeds University to try and assess the benzpyrene produced by diesel engines underground. These tests had not yet been finished but so far it

The North-West Division at Carrington Power Station

appeared pretty definite that if a diesel engine was kept in good condition and was run in an efficient manner there was no increased danger of cancer of the lung due to breathing in the fumes.

After lunch the Chairman introduced the second speaker, Mr. B. Quick, Divisional Chief Mechanical Engineer, who gave a talk on " preventative measures taken to minimize the emission of toxic gases from diesel engines." Mr. Quick explained the ventilation system of the Yorkshire Main Colliery, and also the scheme for care and maintenance of diesel locomotives. He also informed the Council that samples for analysis were regularly taken from the exhaust gases of these locos, both when the engine was working at full speed and with a full load and also when the engine was idling. Bad samples had been very rare, and he attributed this to the efficiency of the drivers and maintenance men.

The meeting concluded with the showing of a film " Underground Diesel Locomotive Maintenance," which illustrated very clearly the points made by Mr. Quick in his talk. After questions and discussion the Chairman thanked the Management for their kind hospitality, and the officials of the Yorkshire Main Colliery and the N.E. Division of the Board for their very helpful explanations and answers to members' questions. Members were then shown a diesel locomotive in the colliery yard and inspected the skip winding mechanism, etc.

South East

A General Meeting of the South East Division was held at Caxton Hall, S.W.1, on the afternoon of 19th July. The chair was taken by the Society's President, Dr. Lessing.

An address was given by Mr. T. F. Hurley of the Fuel Research Station of the D.S.I.R., on " Instrumentation in Relation to Smoke Density." Mr. Hurley described the various methods of smoke measurement in use, both for giving information to the boiler house personnel, and for enabling the smoke inspector to measure, from outside a factory, the degree of smoke emission. Of the former, he outlined the construction of both simple visual systems and those using photo-electric cells. In describing the Ringelmann chart and other devices to assist the smoke inspector, Mr. Hurley gave an account of a new telescopic device which was being developed by one of his colleagues. He thought that this would overcome many of the disadvantages of the Ringelmann chart.

In addition to the address by Mr. Hurley, there was a comprehensive exhibition of instruments by a number of manufacturers, devised to afford assistance in ensuring the minimum of atmospheric pollution by smoke, dust, grit, etc., and in effecting economy in the combustion of fuels.

North West

The North West Division held its Annual General Meeting on 30th May at the modern power station at Carrington. The delegates were welcomed by Mr. A. R. Cooper, the Controller, who said that in the Division, with its sixty power stations having a capacity of four million kilowatts, burning eight million tons of fuel a year to produce 20 per cent. of the nation's electricity requirements, there was a constant drive towards improved efficiency which played an important part in the abolition of smoke.

He went on to say that at Carrington—which was typical of all modern power stations throughout the country—electrostatic precipitators had been installed at a cost of nearly half a million pounds, solely in the interests of clean air. Training was also a very important aspect and already 1,000 of their boiler house operatives had taken courses of instruction, either at Horsley Towers or at Buxton or by attending technical colleges or taking correspondence courses. Two hundred and fifty of them had been

The Scottish Division looks up, at a Gas Works, while——

successful in obtaining a City and Guilds Certificate in Boiler House Practice.

Investigations were constantly being carried out and at the present time experiments were being made to reduce the sulphur content of smoke by injecting ammonia into the flue gases. At Lancaster and Barton Power Stations there were stocks of low sulphur content fuels which would be used only when there was a warning from the meteorological people that a fog was imminent.

At Bloom Street, situated within the Manchester smokeless zone, there was a district heating scheme which was at present supplying city warehouses and offices and will eventually supply heat to the new College of Science and Technology. At Kearsley Power Station four boilers had been fitted with a special mechanical grit extraction plant costing £120,000.

All these activities, together with nuclear power, contributed to a cleaner atmosphere and in Mr. Cooper's own words " they make us partners with the National Smoke Abatement Society in their work towards cleaner air."

After the meeting members were conducted on a tour of inspection of the station and also saw an exhibition which had been arranged to illustrate the work of the Authority on combating atmospheric pollution. A model of an atomic power station and instruments used in connection with the measurement of atmospheric pollution were on display.

South Wales

After an initial period of some difficulty and inaction, the South Wales and Monmouthshire Division met at Cardiff on 22nd July, in good strength. Alderman Dr. Bence, the Chairman, intimated that he sought to retire from this position, and Alderman D. J. Fisher of Swansea was unanimously elected Chairman in his place. Alderman Bence was congratulated on his appointment as a member of the Clean Air Council. Mr. A. J. Dalton, who is an elected member of the Executive Council, was elected as the new Honorary Secretary.

A discussion on the Clean Air Act and on the new work of the Society

——the North-West Division looks up at a Power Station

was opened by Mr. Ieuan Lewis and Mr. Arnold Marsh.

Joint Divisional Meeting

New ground was broken when a joint meeting of the North West, Yorkshire, West Midlands and East Midlands Divisions was held at Derby on 26th June last. The meeting was held in the demonstration theatre of the East Midlands Electricity Board, which had kindly placed it at the disposal of the Society. The attendance was close on 150, and all the Divisions were well represented. The paper read, by Mr. C. J. Stairmand, of I.C.I. Ltd., was of especial interest and is printed in full in this issue. The discussion was opened by Mr. G. W. Farquharson, Hon. Secretary of the West Midlands Division, who was followed by a number of other speakers, many of whom put practical questions to the speaker. Dr. Lessing, President of the Society, was in the chair.

HASTINGS

This issue will appear just before the conference opens at Hastings, and full particulars will have been received by all who have been registered to attend. Even some weeks before the date the number listed was approaching last year's record figure of 679. The papers that at the time of writing have been received for advance printing are of high quality and will undoubtedly arouse much interest and lead to good discussions.

U.S.A. " Clean Air Council "

A National Advisory Committee on Community Air Pollution has been established by the Public Health Service of the Department of Health, Education and Welfare.

The Committee, under Surgeon General Leroy E. Burney as chairman, will review the work and objectives of the Public Health Service's programme and make recommendations to the Surgeon General.—*Washington Post.*

The Impact on Industry of the Clean Air Act, 1956

By

James Strachan, O.B.E., J.P., A.C.W.A.

A Paper read at the Dundee Conference of the Scottish Division

THE Clean Air Act, 1956, has focused attention on the importance of the efficient use of fuel as a deterrent to air pollution. The requirements of the Act need not be regarded by management in industry as onerous, because all the principles involved in the reduction of grit and smoke are well established.

Fuel efficiency is very important in any study of smoke abatement, and although it would be out of place within the terms of this particular paper to show in detail how this can be achieved, perhaps I may be allowed to indicate what can be done in this direction.

The Company with which I am associated (Jute Industries Ltd., Dundee), has given attention to the problem of fuel efficiency for many years, and particularly intensive study and research has been applied to it in the last fifteen years. The success achieved may be measured by comparing our coal consumption per ton of product for the year 1942, with the year 1956. In 1942 we used ·43 tons of coal per ton of product, and in 1956 ·20 tons, or a reduction in coal consumption of ·23 tons per ton of product, or 53½ per cent. This saving represents 14,941 tons of coal per annum, or £78,440 at today's delivered price of coal. In addition it has helped to conserve the nation's coal, and of course, has made a material contribution to smoke abatement.

The problem of saving fuel has been tackled under five heads:

(1) Efficient generation of steam (i.e. boiler plant practice).
(2) Maximum condensate return.
(3) Efficient lagging of pipes.
(4) Efficient utilization of steam for process work.
(5) Efficient utilization of steam for space heating.

Each of our boiler plants is equipped with a feed water meter in order that we may know the actual amount of steam generated by the boilers.

The meter is read by the Plant Engineer at 7.30 a.m. and again at 5.30 p.m. on each working day. A log sheet is returned each week to our costing department and provides the following information:

(*a*) Water fed to boilers during the working period.
(*b*) Water fed to boilers during the "off" period.
(*c*) Temperature of feed water.
(*d*) Temperature of water at Economizer inlet.
(*e*) Temperature of water at Economizer outlet.
(*f*) Temperature of super heated steam (where superheaters are in use).
(*g*) Quantity of coal used per week.

From this information it is possible to work out the operating efficiency of (1) The Boilers; (2) The Economizers; and (3) The Superheaters.

The three results added together give the boiler plant efficiency, and these are sent by the costing department each week to the Boiler Plant Engineer, for his information, and attention if necessary.

As it is quite impossible to operate a boiler plant intelligently without knowing the pounds of steam generated

per lb. of coal used, the absence of a feed water meter, or steam meter in any industrial plant today would appear to denote a sad lack of fuel efficiency consciousness on the part of those concerned. Power House Engineers, although they possess no instruments will frequently assert that the conditions are at maximum efficiency, when there is not an atom of foundation for the statement, and cases are on record when, following such statements, tests have been made, showing the possibility of very large savings.

The present generation is concentrating its energies on increased efficiency, and except in very poor organizations, very careful watch is kept on material and labour in order to avoid or reduce waste. How often do we see the same attention paid to services such as steam, gas, electricity and water? It has become a habit to weigh, measure or count material issued from store, but experience shows that it is equally a habit to give a man a water, steam or gas cock, and let him use it or waste it at his will. Further, if a factory makes its own power, the power house is really a separate factory and should be as efficiently controlled as any other department, yet in far too many factory power houses, tremendous unnecessary waste of heat obtained from expensive coal is going on all the time, unchecked and unheeded, because, if thought of at all, any form of control would entail expense. For some unknown reason expenditure in such a direction is looked upon as a gamble at long odds and not as an investment of a small amount of capital, which will almost certainly bring a better return than any other working capital invested in the business. Let me emphasize then, that the installation of a feed water meter or steam meter is indispensable to the intelligent operation of a boiler plant. Once it is installed, it should be checked for accuracy at intervals, and day-to-day records kept of the water passing into the boilers.

Combustion Efficiency

By far the most important instrument from the point of view of fuel economy and thus smoke abatement is, however, that which indicates or records combustion efficiency in terms of the amount of air used per lb. of fuel consumed, whether it takes the form of a CO_2 meter, an excess oxygen meter or a combined steam flow/air flow meter.

As an illustration a good quality bituminous coal theoretically requires about 9 lbs. of air per lb. of fuel for complete combustion, a condition which it is impossible to achieve in practice. A well operated coal-fired boiler may, however, be expected to consume about 35 per cent. more air than is theoretically required (i.e. 12·2 lbs. per lb. of coal) in which case the CO_2 of the flue gases would be about 14 per cent. The point is that in a good many boilers in the United Kingdom, the CO_2 content of the flue gases is only of the order of 6 per cent. (sometimes lower) which corresponds to over 200 per cent. excess air or about 30 lbs. of air per lb. of fuel. In a Lancashire boiler, *without* an economizer, of which there are many installations in the United Kingdom, an increase in CO_2 from 6 per cent. to 14 per cent. obtained by improving combustion, would reduce the coal consumption, and thus smoke emission by half. In a Lancashire boiler *with* an economizer the same change in CO_2 would reduce the coal consumption by one-third.

Putting the argument in a different form, a single Lancashire boiler may consume 1,600 lbs. of coal an hour. Run inefficiently with say 160 per cent. of excess air (between 7 and 8 per cent. CO_2) which is common, it means that about 10 tons of excess air pass through the boiler every hour, and this air is raised from atmospheric temperature to somewhere about 500° and 1,000° F. in the process. Bearing in mind that there are 120,000 Lancashire boilers in the United Kingdom, all this heat which is uselessly discharged up the chimney represents an unforgivable and prodigal waste of

fuel. Its repression, and this is a straightforward technical problem, might reduce the consumption of coal used for industrial steam raising by as much as 10 million tons of coal per annum.

Experience has shown that the problem of obtaining a high degree of fuel efficiency in boiler and steam utilization plants is not an engineering one,—the real problem is to get management interested and so get fuel expenditure supervised as carefully as are other raw materials, labour, and other overhead expenses.

First and foremost, is the necessity for a trained stoker, and to pay him a minimum wage commensurate with his certified abilities. One should never forget that an inefficient stoker can waste more coal in a day than a miner can produce.

Boiler load conditions affect smoke emission not only in relation to their effect upon the time available to complete combustion in a given space, but also in the maintenance of a correct air-to-fuel ratio. Thus if the load is suddenly reduced when there is a large charge of green fuel upon the grate, it will be necessary to reduce the air supplies in order to avoid blowing off steam, in spite of the fact that tarry vapours will continue to be evolved. The prevention of this state of affairs lies partly in the hands of the fireman, who should avoid the accumulation of green fuel on his fuel bed, and partly with the management, who should endeavour to give the fireman the maximum warning when changes of load are likely to occur. We have found the installation of an audible bell system between the Dressing department and the boiler house effective in giving the fireman due notice of a fluctuating steam demand. The operator in charge of each dressing machine operates the bell 15 minutes before the machine is to close down and 15 minutes before the machine is due to be restarted.

Space Heating Savings

Although the savings effected in steam generating, condensate return, lagging of pipes, and in steam used for process work, have been by no means small, our largest saving has been achieved by means of economy in the use of steam for space heating, and I would, therefore like, with your permission to refer briefly to this aspect of the problem.

At the outset we had to break down the custom of keeping heating steam on continuously from about the beginning of October to the beginning of April, seven days of 24 hours each, or 168 hours per week for six months of the year, *irrespective of the outside temperature.*

A questionnaire was drawn up and sent to each of our works, and replies to the following questions solicited:

1. The time steam supply pipe was opened up to production departments each day for a week?
2. The time steam supply pipe was closed to production departments each day for a week?
3. The outside temperature at 7.45 a.m.? (the then starting hour).
4. The temperature inside the production departments (spinning, weaving, etc.) at 7.45 a.m.?
5. The temperature inside the production departments at 3 p.m.?

As the result of the illuminating information disclosed by the returns, this return has become a regular feature of our fuel saving campaign; and the following figures of the average hours which heating steam was supplied to production departments in all our works during the six months ending 31st March, 1947 (and you will recall that the winter of that year was particularly severe) will help you to appreciate the savings made:

(*a*) Heating on during working period: 33¼ hours out of a possible 51½ hours or 65 per cent.

(*b*) Heating on during " off " period: 33¾ hours out of a possible 116½ hours or 29 per cent.

(*c*) Heating on during working and " off " period: 67 hours out of a possible 168 hours or 40 per cent.

This represents a theoretical saving

of 60 per cent. in coal used for heating.

Mr. Strachan then summarized those sections of the Clean Air Act that are of particular interest to industry, and concluded his paper by saying:

Although designed to correct a social evil the Clean Air Act nevertheless constitutes a powerful incentive to more efficient use of fuel. The cost of the measures to be taken by industry will vary with the nature and the efficiency of the equipment now in use; to some it will be a matter of "putting the house in order," and in other cases it may well mean large scale replacement.

Difficulties are not likely to arise on technical grounds since all the principles involved have been established for many years. Any anxiety which industry may feel on the ground of cost can be allayed by the knowledge that much of the capital outlay will repay handsome dividends.

B.C.U.R.A. REPORT

The Annual Report, for 1956, of the British Coal Utilization Research Association, once more indicates how much of the work being done is either directly or indirectly connected with the prevention of smoke. Indirectly, there is research on the firing of industrial boilers, the new process of cyclone combustion, and a great deal on domestic heating. On this it is reported that testing and development have been undertaken on the production of an efficient but inexpensive small chain-grate stoker for large residential buildings, including work on the special problem of automatic control. There is also a further report on progress with the small-pipe, forced-circulation system of domestic central heating, of which an early account was given at the N.S.A.S. conference at Bournemouth in 1955. Central heating installations for twenty houses have been designed and supervised by the Association and considerable information has been gained on design technique and installation costs.

Smoke Emission Measurement

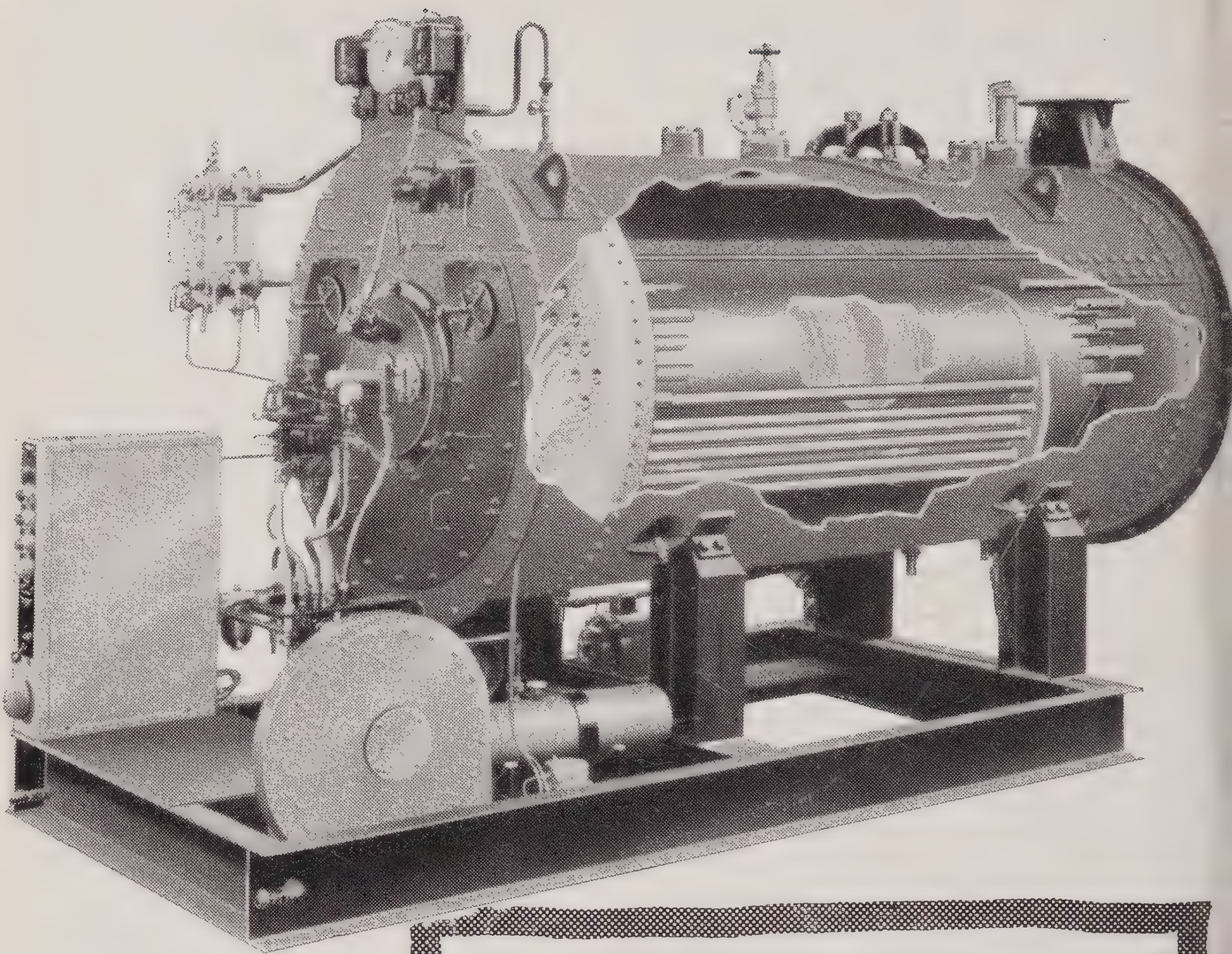
Most interesting of all to us is a section on further research into the measurement of smoke emission, for which accuracy is necessary in testing the relative smokelessness of appliances. It has been shown that the measurements reported by previous workers, on the basis of optical methods, are too low, and an electrostatic precipitator has been used which collects the whole of the smoke. Over the range of conditions investigated the smoke emitted from a number of different types of domestic appliance represented 2·5 to 5·5 per cent. of the weight of the fuel used. "It has been found," continues the report, "that smoke emission (expressed as a percentage of the coal burnt) increases as the burning rate is decreased, and that it is also a function of the weight of the refuelling charge."

Sulphur Release

Work is also in progress, under contract with the Ministry of Power, to investigate sulphur release from fuel beds. Experiments on an open fire have confirmed the conclusion suggested by laboratory tests that the incorporation of an additive in the fuel is effective in reducing the emission of sulphur. Some 70 to 80 per cent. of the sulphur is retained in the ash on burning cold-pressed briquettes containing 5 per cent. of hydrated lime, compared with 25 to 35 per cent. for "plain" briquettes without additive.

First Meeting of Clean Air Council

The Clean Air Council held its first meeting on 11th July under the chairmanship of the Minister of Housing and Local Government, Mr. Henry Brooke.



News from the Local Authorities

Bacup

The Council have instructed the appropriate officers to examine the technical, financial and administrative problems concerned with the establishment of smoke control areas and to report back to the Health Committee. The Council are also to adopt the byelaw relating to the installation of smokeless fuel appliances in new buildings, a draft byelaw having already been agreed by the Minister of Housing and Local Government.

Birmingham

The Health Committee of the City Corporation reported to a meeting of the City Council on 2nd July, 1957, that it had given consideration to the creation of two further smoke control areas in the City. One forms an extension of the existing central area, and the other is 56 acres at Erdington. The Committee has approved in principle the creation of the two new zones and has asked the Minister of Housing and Local Government for comments. The earliest date on which the order is likely to be brought into operation is October, 1958.

Bootle

The Town Council has adopted the byelaw governing the installation of smokeless fuel appliances in new dwellings.

Brighouse

The Chief Public Health Inspector has been asked by the Health Committee to investigate the possibility of establishing a smoke control area in the town.

Dagenham

The Council has adopted the byelaw governing the installation of smokeless fuel appliances in new dwellings.

Denton

The Minister of Housing and Local Government has approved in principle the provisional plan for a smoke control area submitted by the Council and the Chief Public Health Inspector has been authorized to carry out the detailed survey. The area consists of a new council house estate of 300 houses, 60 flats and 4 shops.

Edinburgh

The second phase of the plan to make the Sighthill area of Edinburgh a smokeless zone will cover an area of 125 acres, in which there are 1,002 Corporation houses, in addition to schools, offices and shops.

Approval of proposals for the second Sighthill phase was given by Edinburgh Town Council on 27th June. The Council also agreed that £7,195 be included in the final estimates for 1957-58 to cover the necessary conversion of one fireplace in each house, the detailed arrangements for which are subject to further consultation by the Health Committee with the Housing Committee.

Halifax

The Health Committee appointed a sub-committee on 3rd June to implement the Clean Air Act in Halifax in conjunction with the Development Committee.

Hampstead

The Council has selected the Vale of Health as a pilot area for the beginning of its smoke control area programme.

Hayes (Middx.)

A smoke control area is to be established in Hayes, according to a recent statement by Councillor Mrs. K. M. Johnson. The area will include Printing House Lane, Dawley Road, Digby Row and Botwell Common Road.

Holmfirth

A check has been made to see that

all Council offices are centrally heated, and the policy of smokeless appliances for all new Council houses has been adopted.

Leeds

The establishment of a smoke control area in the centre of Leeds has been approved in principle by the Corporation Health Committee. The plan takes in an area of about 1,000 acres, which includes the General Infirmary at Leeds, the University of Leeds and the new light industrial estate at Kirkstall. The City Council has also approved the byelaw governing the installation of smokeless appliances in new dwellings.

Leicester

The Health Committee is seeking the adoption of the byelaw governing the installation of smokeless appliances in new dwellings. It has also recommended the establishment of two smokeless zones. The recommended areas are St. Matthews, the new estate to be built in the old Wharf Street district, and part of the city centre. The city centre zone will be bounded by a line running from the Belgrave Gate roundabout via the Clock Tower, High Street, Cart's Lane, Grey Friars, Pockington's Walk, Belvoir Street, Rutland Street, and the lower part of Charles Street. The Health Committee does not intend to make separate new zones but will extend from time to time the boundaries of the city centre zone.

Lewisham

On 25th July the Council passed unanimously a proposal that the first smoke control area in the borough should be set up at Ladywell.

London (County)

The London County Council would like borough councils to tell them about their proposals for smoke control areas in cases where the L.C.C.'s housing estates and other properties are involved. The L.C.C. is prepared to assist other borough councils by lending exhibition material for local publicity in connection with the setting up of smoke control areas.

Manchester

The Manchester Health Committee has adopted for submission to the City Council a plan for initiating smoke control areas under the Clean Air Act, with one in South Wythenshawe, and thence for extending them successively in a northerly direction so as to take advantage of the prevailing winds in freeing the whole city from smoke.

Streets to be included in three new smokeless zones covering about 63 acres of Manchester were disclosed on 30th July, 1957. These districts, along with a 43 acre site at St. Georges, will bring Manchester's smokeless zone areas up to 564 acres. The new zones are at Miles Platting, Ancoats, and Harpurhey.

Mirfield

The Council has adopted the byelaw governing the installation of smokeless fuel appliances in new dwellings. All post-war council houses are fitted with grates for smokeless fuel.

Newcastle-upon-Tyne

Three more smoke control areas, fringing on the central area already zoned in Newcastle, have now been defined. No. 2 (west central area) includes Northumberland Street, Percy Street and Gallowgate and extends across Corporation Street and Westgate Road to Waterloo Street. No. 3 (east central) area includes City Road, Trafalgar Street and the Quayside district. No. 4 (north east central) area covers the area east of Northumberland Street, including Osborne Terrace and Jesmond Road.

Nottingham

Subject to Ministerial approval, the centre of Nottingham will become a smoke control area by May 1959.

Perth

Perth's plans for a smoke control area, starting with the first four houses of a block of 32 nearing completion in the Pomarium Street—Cross Street area, were outlined at the

National Smoke Abatement Society's Scottish Conference by Dr. R. Ritchie, Convener of Public Health. He also spoke of voluntary experiments with smokeless fuels which were being conducted with the co-operation of some Council tenants.

St. Marylebone

The Public Health Committee has recommended that No. 3 (St. John's Wood Terrace) ward should be declared a smoke control area. One reason this ward was chosen was because of its proximity to Regent's Park and Primrose Hill.

Sedgley

The Sedgley Urban District Council has adopted the byelaw relating to the installation of smokeless appliances which has now been confirmed by the Minister of Housing and Local Government and will come into operation on 1st July, 1957.

The Council has also submitted details of a proposed smoke control area in Sedgley and this has now received the informal approval of the Ministry. Steps are now in hand for the statutory inspection of the necessary houses. In the proposed smoke control area there are 485 houses of which 301 are owned by the Council.

Stoke Newington

The Council is co-operating with neighbouring boroughs to form a smokeless zone. A start is planned at Woodberry Down, in the northern part of the borough where there is a large London County Council estate and an experimental health centre.

Tottenham

As an extension to their existing Smokeless Area Order, made under a local Act, the Council has approved, in principle, an area of some 180 acres being included in a Smoke Control Order to be made under the Act of 1956. The survey of some 1,700 houses and other premises is in hand and in due course the order will be submitted to the Ministry. The Council has approved the adoption of the model byelaw governing the installation of smokeless appliances in new buildings.

Wakefield

Agreement was given by the Health Committee to the setting up of an Advisory Panel, as suggested in a letter from the West Riding Clean Air Advisory Council, for the purpose of assisting local authorities in dealing with the problems involved in the operation of the Clean Air Act. The Medical Officer of Health reported that the authority had been asked to co-operate in investigations to be undertaken on behalf of the Medical Research Council into the relationship between air pollution and respiratory diseases, particularly in relation to improvements which it was hoped would follow as the result of the Clean Air Act. After hearing of the cost of setting up five sampling points in different parts of the City, it was decided to co-operate in the research.

Wandsworth

The borough is to have a smoke control area, but the Council has not yet decided in what part of the borough it will be. The General Purposes Committee is to experiment with a pilot scheme in a suitable district and, if it is successful, the smoke control area will be extended until it applies to the whole of Wandsworth's 9,000 acres.

The Council has allocated £1,000 for their first smoke control area, when a suitable area has been selected.

Warrington

The Chief Public Health Officer (Mr. H. A. Richardson) has submitted a report to the Related Health Services Committee of the Council concerning the town's first smoke control area, and has suggested that the most suitable area would be in the Orford district, bounded by Earl Street, Longford Street, Marsh House Lane, O'Leary Street and the Manchester-Liverpool railway.

Warwickshire

The Warwickshire Clean Air

Taking it in. Studying some of the Society's photographs on a display arranged by the Harrow Public Health Department at a recent conference of the Women's Gas Federation

Council's technical advisory committee has advised the acceptance throughout Warwickshire of the byelaw governing the installation of smokeless appliances in new buildings.

Wembley

The Council has agreed in principle to setting up a smoke control area in the town.

Westminster

Plans to include the area around Kingsway, Aldwych, Lancaster Place and the east end of the Strand in a smokeless zone were announced on 20th May by the City Council. The new zone is to be bounded by the Thames on the south, Lancaster Place, Aldwych, Kingsway, the Law Courts, Chancery Lane and Temple Steps.

Two further areas are contemplated: 1. All properties within the area bounded by the south side of the Strand, the east side of Whitehall as far as Bridge Street and the Thames. 2. The rectangular area bounded by the north side of the Strand, the east side of Trafalgar Square, St. Martin's Place, Charing Cross Road, and the boundary with Holborn.

Smoke Abatement Notice

It is reported that Chesterfield Rural Council has served the N.C.B. with a smoke abatement notice in respect of Holmewood Colliery, Derbyshire, which requires them to check pollution within 28 days. If this is not done the Council will apply for a Nuisance Order in the Courts. The Council alleges that during one month at Holmewood nearly 200 tons of grit and dust fell over a square mile.

The Prevention of Grit and Dust Emission

Some Technical Aspects

By

C. J. Stairmand, B.Sc., M.I.Chem.E., A.Inst.P.*

A Lecture read to the Joint Divisional Meeting of the National Smoke Abatement Society at Derby on 26th June, 1957.

WHEN the Clean Air Act becomes fully operative local authorities will have a considerable task in seeing that all is being done to reduce atmospheric pollution, at least so far as the Act gives them power.

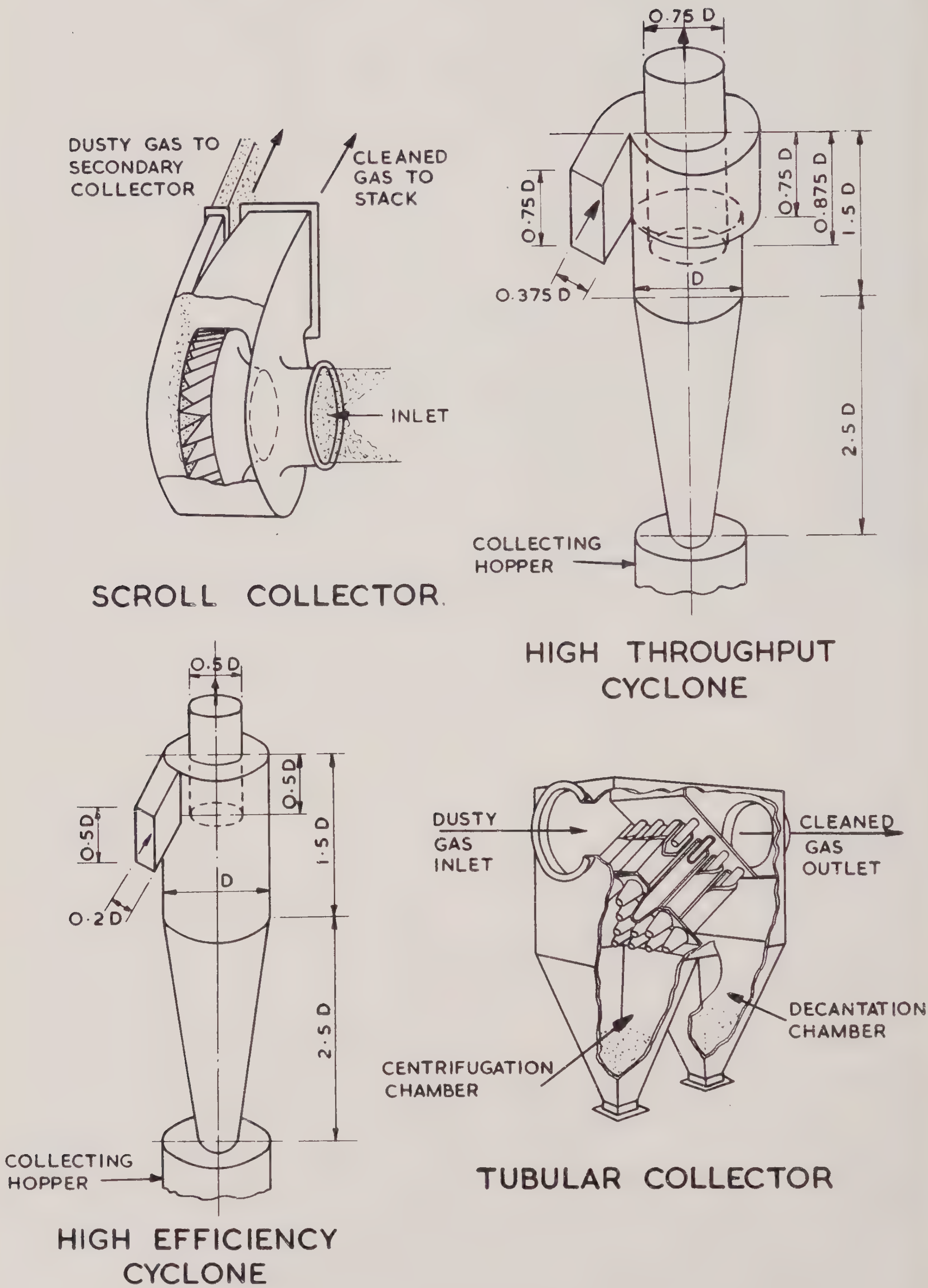
The Act states that dark smoke shall not generally be emitted from chimneys or stacks, and that the emission of grit and dust shall be minimized. New furnaces shall be fitted with plant to arrest grit and dust and plans for the larger plants are to be approved by local authorities before the plant is installed. Also, installed plants are to be tested when the local authority so desires, in order to check that the grit and dust arrestors are of the required efficiency and are being maintained and operated properly.

Further, the local authorities are to examine plans for all new chimneys which are to carry smoke, grit and dust, or gases from furnaces.

All of this places a very considerable burden on the local authorities. It is clear that they will have to take steps to familiarize themselves with what equipment is available so that they can give the necessary advice, or at least ascertain that given plants are, in fact, employing the " best practicable means " within the limits set out in the Act. " Practicable " as defined in the Act means that account must be taken of the requirements of the locality, the economics of the situation, and the present state of technical development in the field. It implies also that as technical development produces better equipment, use must be made of the improved equipment, even in old plants.

The Clean Air Act does not give a figure for the performance expected from " the best practicable dedusters," nor for the emission of dust and grit which is permissible in a given set of circumstances. It is sometimes clear that a given plant is a source of nuisance, *e.g.* when it emits dense clouds of black smoke and heavy deposits of grit fall adjacent to its stack, but in the majority of cases the evidence is not so clear-cut. We may then be faced with deciding whether a given plant is, in fact, causing a nuisance and here we are hampered by the lack of a suitable yardstick by which to judge a nuisance. Apart from complicated legal definitions, with which we are not here concerned, it may be said that a plant causes a nuisance if its effects on the local amenities are readily detected without the use of special instruments; and conversely that a nuisance has been abated if the effects are so far reduced that the change is obvious. It might be argued that we should aim to avoid *all* discharges of dust, grit and noxious gases, but this, as you will see later, is a council of perfection, is unattainable, and is, in fact, not called for either by the Beaver Report or by the

* I.C.I. Ltd., Billingham Division.


DUSTY GAS TO SECONDARY COLLECTOR
CLEANED GAS TO STACK
INLET
SCROLL COLLECTOR
0·75 D
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COLLECTING HOPPER
HIGH EFFICIENCY CYCLONE
DUSTY GAS INLET
CLEANED GAS OUTLET
DECANTATION CHAMBER
CENTRIFUGATION CHAMBER
TUBULAR COLLECTOR

Fig. 1

Clean Air Act. A year or so ago, the Chief Engineer of the du Pont Company in America, speaking on a similar topic said, " You must not expect that clean air will come overnight, or soon, or even at all. The only way in which this can be achieved is to give up our automobiles, our washing machines and our central heating systems, and give the country back to the Indians."

It is of interest to examine what can be achieved with rather less sacrifice, in this country, without saddling our industry with intolerable burdens. Sir Ewart Smith, in a recent address to the Institution of Mechanical Engineers, put the cost of implementing the Beaver Report at £625,000,000, which he called " burdensome, but not intolerable." For this sum of money we will not get clean air—far from it—but we would avoid the dark palls of smoke and heavy dust depositions which in some districts are signs of obvious pollution.

Let us consider what can be done to reduce this pollution. We are concerned:

(*a*) With grit deposits, more or less adjacent to effluent stacks.

(*b*) With dust emissions which give the drab appearance to buildings and vegetation in the more heavily industrialized districts.

(*c*) With the dark appearance of the plume as it leaves the stack, and the obscuration of sunlight which it produces as it disperses in the ambient atmosphere.

Considering first the deposits of grit and heavier dust particles, it can generally be assumed that these fall within about a mile of the source of discharge and will consist of the larger particles, say, those larger than 30 microns.*

Types of Collector

Most of the gross dust deposits can be avoided by even the simplest dust-collecting devices. Fig. 1 shows in diagrammatic form four types of centrifugal dust collector. The first type is the simple inertial collector, integral with the main induced-draught fan, the grit particles being shunted into a compartment which is emptied either continuously in a purge-air stream or by gravitational discharge. These collectors have a low resistance, about $\frac{1}{2}$ in. w.g., and are relatively cheap. Alternatively, they may take the form of baffled settling chambers or attachments to the stack, arranged to give the gas a sharp change in direction, throwing out the coarser grit particles.

The second type of centrifugal collector is the simple cyclone; single cells up to 10 ft. or 12 ft. diameter, or even larger, are employed and resistance is usually about $\frac{1}{2}$–$1\frac{1}{2}$ in. w.g.

The third collector shown is the modern high-efficiency long-cone cyclone with dust hopper. These cyclones are usually fairly small, seldom more than about 3 ft. in diameter, and several are nested together to take the full gas load. Resistance is usually 3–5 in. w.g.

The last dust arrestor shown is the modern high-efficiency tubular collector. The cells are usually 6 in. to 9 in. diameter, and a boiler burning 1 ton/hr. of coal would probably require 20-40 cells according to their diameter. The resistance would be 2 in. to 3 in. w.g.

It should be noted that some of these collectors require a fair amount of space for their accommodation and impose an additional resistance to the gas flow. In plants where there are no induced-draught fans it is unlikely that any but the simplest collector can be installed in view of the low draught available. All of these points must be considered when deciding what is " practicable." With new plant provision will, of course, be made to accommodate equipment of the necessary efficiency.

All of the collectors shown in Fig. 1 will give a marked reduction in dust

* 1 micron (μ) = 1/25,400 in = 1/1,000 mm.

TABLE I—DUST DEPOSITION RATES FOR 23,000 LB./HR. BOILER PLANT

Type of Dust Arrestor Fitted	*Maximum Dust Deposition Rate tons/sq. mile/month*
None	1,560 at 70 yd.
Scroll type	7 at 120 yd.
High-throughput cyclone	3 at 300 yd.
High-efficiency cyclone	2 at 240 yd.
Multicyclone	1 at 230 yd.

TABLE II—DUST DEPOSITION RATES FOR VARIOUS TYPES OF DISTRICT

Class	*Dust Deposit tons/sq. mile/month*
A. Health resorts and seaside towns	<13
B. Small towns	13–38
C. Large towns (not highly industrialized)	38–64
D. Industrial areas	>64

deposition rates, as shown in Table 1*. This shows that a single boiler, burning 1 ton/hr. of coal, could cause a maximum deposition rate of 1,560 tons/sq. mile/month if no deduster were fitted; if fitted with the simplest dust collectors the deposition would be reduced to only 7 tons/sq. mile/month. The more elaborate centrifugal dust collectors would reduce the deposition even further—to 3 tons, 2 tons or 1 ton/sq. mile/month, according to the complexity of the installation. These figures should be compared with average deposition rates for various types of district. Table II shows typical figures for four localities. It will be seen that seaside towns and health resorts generally show deposition rates below 13 tons/sq. mile/month while small towns may record about twice this figure. Highly industrialized districts may have deposition rates exceeding 64 tons/sq. mile/month. Thus fitting good cyclones to a boiler plant which, in their absence, would give an intolerably high deposition rate, would ensure no more dustfall than that observed in seaside resorts. These figures show the striking improvement that is possible by using modern dust-collecting equipment, but it should be noted that much of the gain will be nullified if the equipment is of poor design or of faulty construction, or if adequate maintenance is not given. This leads to the question of accurate testing, both of initial performance, and of the performance which can be maintained, day in day out throughout the year; this aspect is discussed later.

* Tables I–IV are taken from "The Role of the Cyclone in Reducing Atmospheric Pollution," Chem. & Ind., Oct. 1955, by C. J. Stairmand and R. M. Kelsey.

The Smaller Particles

After grit deposits have been dealt with we must face the question of deposits of the smaller particles, which while not discernible individually by the naked eye, nevertheless can accumulate over a period so as to discolour vegetation and buildings, or entering dwellings via open windows and doors, can deposit on furnishings and decorations so as to soil them. A colleague has shown that in general such deposits are not detectable unless they cover more than 0·2–0·4 per cent. of the surface on which they rest. Such coverages will not arise from the small boiler plant referred to earlier if the dust emission is below 0·2 gr./ft.[3],

TABLE III—EMISSION FROM 23,000 LB./HR. BOILER PLANT WITH VARIOUS DUST ARRESTORS FITTED

Type of Arrestor	*Emission grains/N. cu. ft.*
None	1·1
Scroll	0·32
High-throughput cyclone	0·21
High-efficiency cyclone	0·1
Multicyclone	0·08

provided that no similar plants are in the immediate neighbourhood. In referring earlier to dust-deposition rates the *maximum* values likely to arise from the given emissions were quoted. These maxima are very sharply defined and the rate of dustfall is greatly reduced at very short distances on either side of the maximum position. This means that maximum deposition rates are seldom cumulative unless the stacks are cosited. But this is not necessarily the case when considering the fall-out of the smaller particles or the build-up of dust concentrations in the atmosphere. Where there are a number of plants in a particular district the effect may well be cumulative and much higher standards, not necessarily attainable with simple equipment, will be called for from the individual plants.

It will be seen from Table III which gives the actual dust emission from the boiler plant considered earlier, that the better cyclones will give a satisfactory emission for a single plant, but even the best would not do if several plants were making a cumulative contribution to the dust-deposition rate. This is, of course, one of the main difficulties of setting an arbitrary limit in the planning stage to the permissible emission from a plant. A low limit which would cover all circumstances would not only be unattainable with reasonable equipment, but would be unreasonably low for an isolated plant. Clearly those who propose to set these limits, or agree proposals for new plant, will have to familiarize themselves with the requirements of the locality, and with the possible performances of available equipment.

Obscuration of Sunlight

The third effect of dust emission, viz. the obscuration of sunlight, is much more difficult to deal with, particularly when we consider it in terms of the actual appearance of the plume as it leaves the stack and spreads into the ambient atmosphere. The obscuring power of a plume, or the black or coloured appearance which it assumes when viewed against a clear sky, depends on the surface area of the particles which it carries (or more accurately the projected area of the particles) and this is enormously increased for a given weight of emission as the particles comprising it become smaller. This is strikingly illustrated in Fig. 2* in which the two

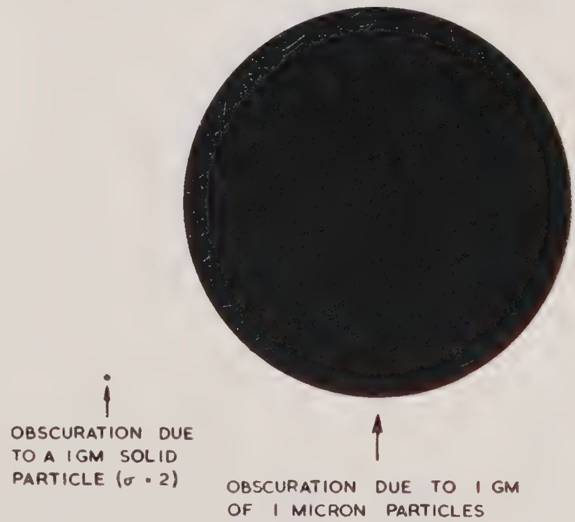


Fig. 2

* Based on a slide shown in Sir Ewart Smith's address to the Mechanical Engineers' Conference on Clean Air, Feb. 1957.

TABLE IV—REDUCTION IN BLACKNESS OF THE PLUME

Type of Deduster	*Reduction in " Blackness " Per cent.*
None	—
Scroll collector	19
High-throughput cyclone	38
High-efficiency cyclone	60
Multicyclone	65

circles show the comparative blackness of one gramme of soot as a solid sphere and as a dispersion of one-micron particles. It should be noted, in passing, that the single solid particle has now become one million million particles, each a potential nucleus for growth of a fog particle if the surrounding atmosphere contains sufficient moisture! It is, therefore, very important that we should remove these smaller particles, if we can, but unfortunately they are exceedingly difficult to trap. Table IV shows how the four centrifugal dedusters considered in the earlier examples would affect the blackness of the emitted plume. It will be seen that the simplest collector only reduces the blackness by 20 per cent. and the best by less than 70 per cent. The latter may seem a not unreasonable reduction but, in fact, the change in appearance would be barely discernible to the naked eye, and casual observers would probably decide that nothing at all had been achieved! In any case the slightest mal-operation of the boiler, or the temporary non-availability of a suitable fuel might result in the emission of black smoke sufficient to nullify the improvement given by the centrifugal collectors.

So far we have considered only the rather simpler collectors. For the very large plant, such as the mammoth power stations now being erected, more effective dedusters are available but only the most expensive (which for the largest stations might cost more than a million pounds) are even reasonably effective on the smaller particles.

It is outside the scope of this article to give details of these more elaborate plants. However, Table V* shows the efficiency of most of the better known types of dedusters on various sizes of particles. It will be seen that none of the simpler collectors has a useful efficiency on the smaller particles, and fabric filters or electrostatic precipitators are necessary where discoloured plumes must be avoided. They cost up to ten times as much as the simpler equipment both in first cost and in running cost and often pose considerable technical and economic problems in particular cases. However, as stated earlier, consideration of such equipment is beyond the scope of the present article.

In the more restricted field of dealing with emissions from the smaller fuel-burning plant it may, therefore, be said in summary that grit emission can be dealt with fairly easily (provided that space is available for the necessary equipment); dust emission can be reduced with rather greater difficulty; the appearance of the plume is most difficult of all to deal with unless it can be improved " at source," e.g. by attention to proper combustion.

Chimney Height

Local authorities are required under the Clean Air Act to examine plans for all new chimneys and satisfy themselves that these are of sufficient height to prevent the discharged gases and

* Table V is taken from " The Design and Performance of Modern Gas-cleaning Equipment," by C. J. Stairmand, J.Inst.Fuel, Feb. 1956.

TABLE V—EFFICIENCY OF DUST COLLECTORS*

Dust Collector	*Efficiency at 5μ*	*Efficiency at 2μ*	*Efficiency at 1μ*
	%	%	%
Medium-efficiency cyclone	27	14	8
High-efficiency cyclone	73	46	27
Low pressure-drop cellular cyclone ..	42	21	13
Tubular cyclone	89	77	40
Irrigated cyclone	87	60	42
Electrostatic precipitator	92	85	70
Irrigated electrostatic precipitator ..	98	97	92
Fabric filter	>99·9	99·9	99
Spray tower	94	87	55
Wet impingement scrubber	97	92	80
Self-induced spray deduster	93	75	40
Disintegrator	98	95	91
Venturi scrubber	99·6	99	97

* For dust of s.g. 2·7 g./cc.

dust from reaching ground level in sufficient concentrations so that they are prejudicial to health, or constitute a nuisance. As there are no agreed figures for such concentrations we are again presented with a difficult problem. It is clearly an advantage to be able to predict what ground-level concentrations are likely to arise from a given discharge (or conversely to predict the tolerable discharge to give a required ground-level concentration). Much study has been given to this subject. The problem is extremely complicated because of the large number of variables involved, including the local meteorological conditions and the topography of the surrounding district. Nevertheless methods are available for predicting the pattern of dispersion of a plume. The formulae involved are extremely complex and are fully understood only by the specialists—they are, however, not particularly difficult to apply if the parameters are known and the results obtained from them are of sufficient accuracy for the purpose in mind. A greater difficulty arises because the formula are, strictly speaking, applicable only when the stack is isolated. The presence of high buildings near the stack causes eddies which may bring the plume down to ground level much sooner than predicted from the formulae, so that ground-level concentrations become much higher than expected.

Empirical rules for effective stack heights have been formulated in the past but these generally lead to high and expensive stacks for all but the smallest plants. In one of the newest American power stations three stacks each 680 ft. high, each costing 800,000 dollars have been fitted! It is clear that cheaper alternatives are available, particularly when effective dust arrestors are fitted. For the larger plant it is often necessary to carry out wind-tunnel tests on models of the proposed stack and local buildings, including any particular geographical features of the neighbourhood. Such tests are generally quite expensive and are usually only justifiable for the very largest installations. Fig. 3 shows a typical record from such a test, showing how the presence of the station buildings has caused the plume to fall instead of rising as it would do from a free stack.

Fig. 4 shows a severe case of " down wash " where eddies in the lee of the stack have caused a considerable " pull-down " of the plume, even in the absence of " down draught " from adjacent buildings.

Since the main purpose of gas-cleaning installations is to avoid the

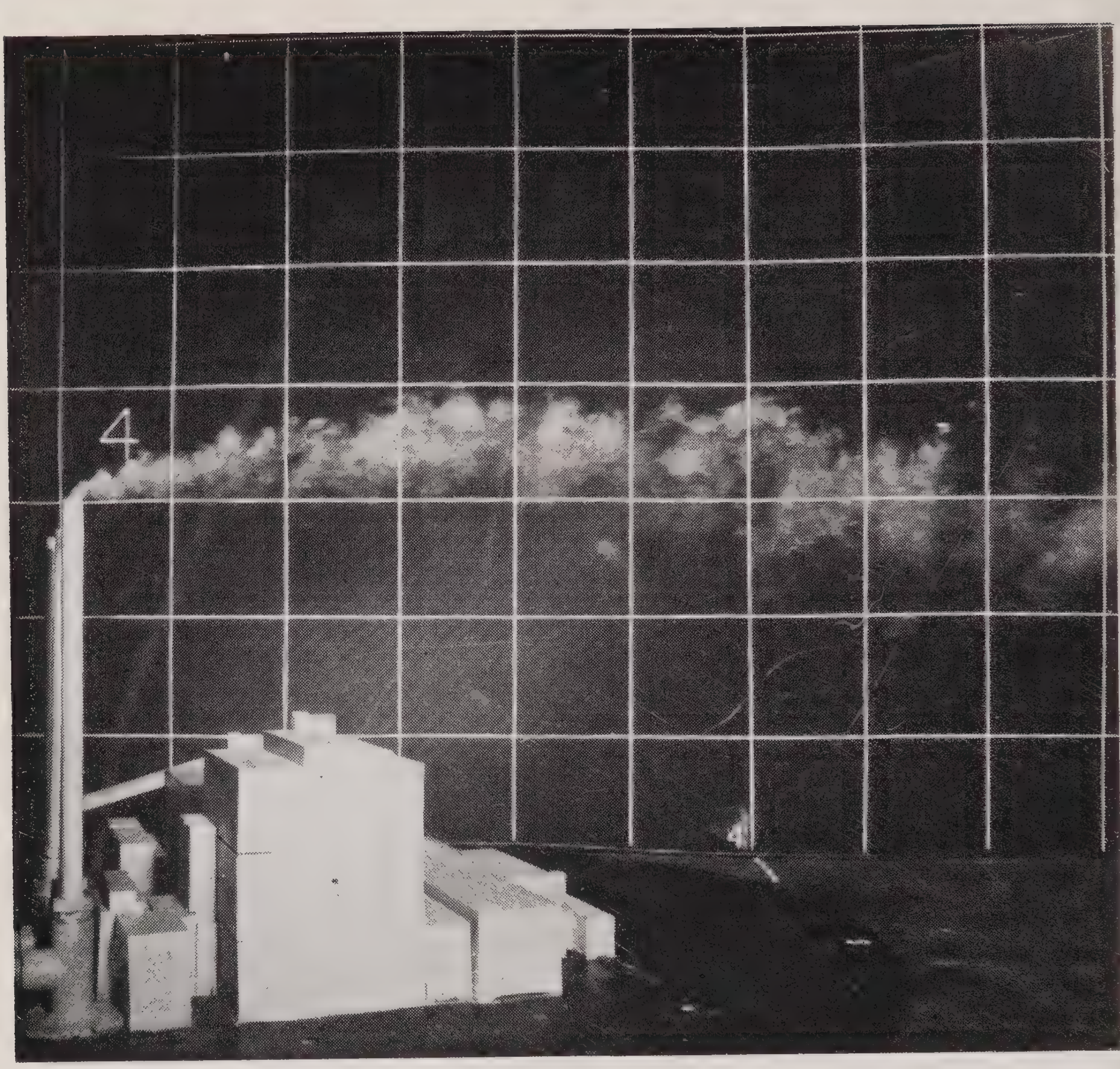


Fig. 3

build-up of harmful concentrations of dust and noxious gases at ground level, it is clear that the design of the stack should be considered when the actual arrestment equipment is being chosen so that the optimum combined effect of low emission and adequate dispersal may be obtained in the most economic manner.

Measurement of Emissions

Finally it is appropriate here to consider methods of measuring emissions. Reliable and accurate measurements are extremely difficult to make and a great deal of thought has gone into this subject. Equipment is available for making complete tests on operating plant, but such tests are quite expensive to carry out and require teams of trained operators. A full test for emission from a large power station, including measurement of the size of the emitted particles, which information is required to give a complete picture of the likelihood of excessive pollution, may cost £1,000 or more, and the equipment used in making the tests with appropriate auxiliaries would probably cost a further £1,000. Fortunately, complete tests of this type are usually only required for research purposes or for acceptance tests on the larger installations. Simpler methods will often suffice where less information is required. Nevertheless attempts to devise a simple standard apparatus of wide application have met with considerable difficulty, and a B.S.I.

Fig. 4

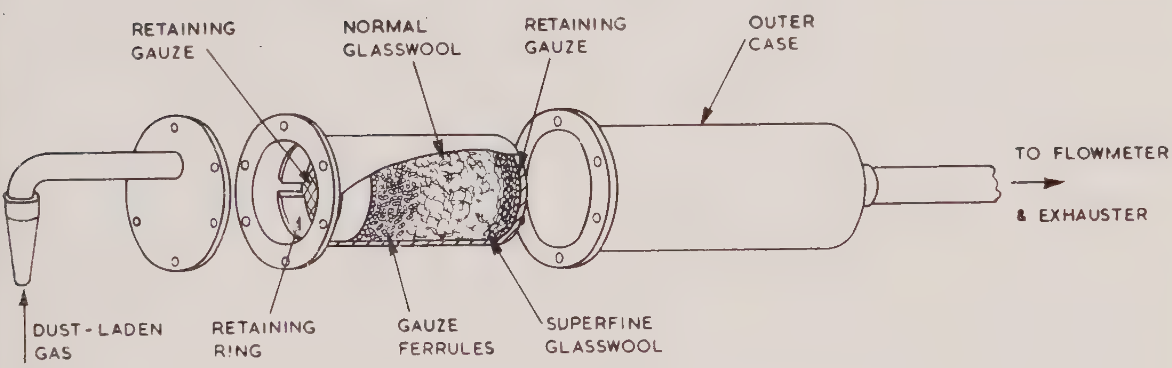


Fig. 5

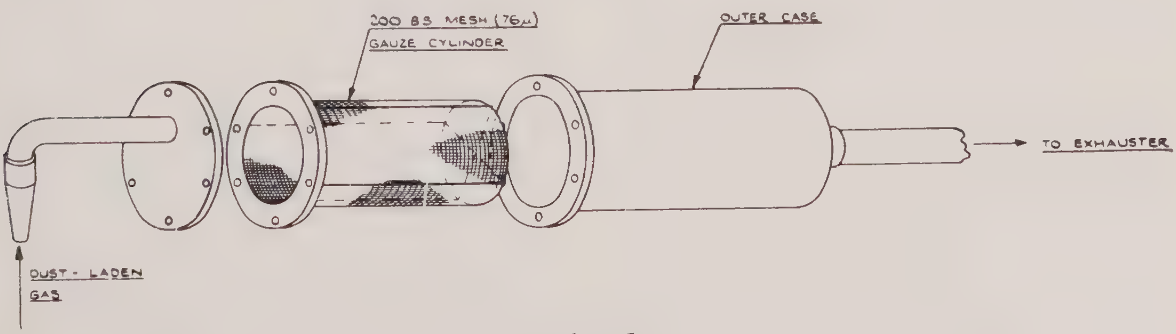


Fig. 6

Committee engaged in formulating a technique has not yet succeeded in its purpose, though the work started immediately after the publication of the Beaver Report in 1954. Some simpler apparatus developed by I.C.I. is illustrated in Figs. 5 and 6; these have proved useful in practice, and may form the basis of the proposed specification.

One of the greatest difficulties in attempting to carry out such tests lies in finding a suitable location for taking the samples. The selection of a point where the dust and gas flow are reasonably uniform is not easy, and is often practically impossible in the older plants. Local authorities, in approving new plants, should make certain that adequate facilities are available for carrying out the required tests.

It has not been possible to do more than touch on the general principles of grit and dust abatement. While reference has been made to removing grit and dust from the flue gas from a small boiler plant, the principles stated apply fairly generally. It is hoped that the views expressed will give local authorities some idea of what is involved in broadly meeting at least some of the requirements of the Clean Air Act.

Conference in Bristol

A Conference on the Clean Air Act was held at the University of Bristol on 23rd May last. It was arranged by the Bristol and West Clean Air Committee, and was a combined meeting with the Society of Medical Officers of Health and the Association of Public Health Inspectors. The speakers were Dr. W. R. Martine, Administrative Medical Officer of Health, Birmingham, and Mr. W. McGrath, Public Health Inspector, City of London. The discussion was opened by Prof. R. C. Wofinden, Medical Officer of Health, Bristol, and Mr. A. Tyler, Chief Public Health Inspector, Bath.

During the course of his speech, Dr. Martine said that experience in the Midlands had shown that public ignorance was so general that a special effort must be made to educate the public wherever a smoke control area was going to be established, from the very moment when the local authority began thinking about it. The health case against pollution of the atmosphere must be put again and again. The cheaper running costs of burning smokeless fuel in an approved grate must be stressed so as to counter the complaints about the higher price of the fuels.

Dr. Wofinden told the conference that although no schemes for smoke control areas in Bristol had yet been drawn up, the setting up of two areas was envisaged. He thought the people of Bristol were on the whole pretty health conscious, and he had confidence in their commonsense to co-operate in things that were going to improve their health. But, he warned the conference, they must expect to encounter a good deal of opposition to smoke control areas in the city, some of which would come from vested interests, and they would find that smoke control was an expensive business.

They were also going to come up against the problem of the " Why pick on me? " attitude. " I hope we are not going to have the problem of the people of North Bristol who would be all in favour of a smokeless zone in South Bristol, and the people of South Bristol who would be all in favour of a smokeless zone in North Bristol," Dr. Wofinden said.

He went on to say that although it was a " black area " within the terms of the Report on Air Pollution, Bristol was, of course, nothing like as bad as Birmingham, London, and other places. However, they had a duty to clean up the air of Bristol even further. It was much better to prevent atmospheric pollution than to let it happen and then try to improve the situation.

A SUBSIDY FOR FUEL–PLUS RATIONING?

The final—and more provocative—part of the Presidential Address to the Institute of Fuel, delivered on 24th April, 1957, by Mr. J. R. Rylands. The full address, " Fuel Efficiency " is published in the May 1957 issue of the Journal of the Institute.

Sir Oliver Lyle, in his well-known paper* on " Inefficiency " presented to the Institute in 1946, set out in some detail certain aspects of the inefficiency of utilization of our fuels. He maintained that annual savings of the order of 80 million tons of coal were feasible by the ordered application of existing knowledge and technology. What was lacking, he emphasized, was a sufficient urge, a motive strong enough to persuade those on whose shoulders the decision rested, to take the appropriate and effective steps.

Discarding both exhortation and personal gain as adequate incentives, he proposed to provide the missing urge by laying a heavy excise duty on fuel. The idea was that the fuel users would not be able to face the extra expenditure incurred in wasting fuel. But the suggestion was made before the pattern of functioning of the large industrial agglomerations was fully known; it is evident now that such a duty could have had disastrous effects. In these industries as in many others the higher costs would simply have been passed on. Some economies might have been made in those industries which could not pass on the higher costs, but even this is doubtful. What is tolerably certain is that there would have been a pronounced inflationary effect.

But these self-same considerations nevertheless indicate how great a contribution *could* be made to the welfare of the community by intelligently applied fuel technology. Fuel is a basic raw material, the cost of which enters into the cost of nearly everything we see around us. In one way or another fuel and its derivative power enter into practically every material element in our lives. The cost of fuel has an important influence on the cost of nearly everything else. Even those industries which directly use little fuel require other materials into which the cost of fuel or power enters largely. We have had plenty of examples, in recent years, of rising fuel prices being passed on. They are part, and an important basic part, of the inflationary spiral; the cost of all manufactured commodities rises; the cost of living goes up; wage increases are demanded and the other great element in costs increases. Rising fuel costs and inflationary tendencies would seem to be inseparable.

Cannot the process be reversed? In the past, when fuel was cheap, the cost of living was low and the country by and large was held to be prosperous. It should not be impossible to reproduce the essential element in these conditions. Instead of laying a heavy excise duty on coal, why not bring down its price by a substantial subsidy? The way to reverse the inflationary spiral is to start at the root. Cheaper fuel would mean cheaper power, cheaper transport, cheaper manufacture, lower prices, greater export potential and a check to inflation. The high cost of nuclear power stations and thereby the cost of the power produced by them would be substantially reduced.

A subsidy such as that proposed for consideration could be an interim measure designed to reverse the inflationary tendency until such time as the nuclear sources of energy became dominant. Could the cost of the subsidy be recovered in the general prosperity consequent on the reversal

* *J. Inst. Fuel,* Oct., 1946, 20, B.1.

of the spiral? Envisaging a possible order of magnitude, let us suppose a subsidy of £3 per ton on 300 million tons of fuel, coal and oil, costing £900 millions. This is about half as much again as the annual cost of the national debt. On the astronomical scale of modern finance it does not seem an excessive amount to lend for prosperity.

But the material lessons of the past would have to be learnt and applied. When fuel was cheap and plentiful in bygone days, it was in general used very wastefully. Where efficiency was pursued, the motive, as has been shown, was usually personal gain. Modern conditions having eliminated this urge some other means would have to be found to ensure efficiency.

The inescapable conclusion might be that the only real way to secure fuel efficiency is by rationing. No other device is so immediately apparent. Such measures may be unpalatable, but they could lead to the road to prosperity, and it is a fast road. Fuel technology would at long last come into its own. It would be the business of the fuel technologist, not only to establish the level of the ration, but to show how it could be made to serve its intended purpose. Methods of control are known; the knowledge of efficient fuel utilization exists. Fuel economy equipment and measures would no longer be regarded as investments and judged on the old " does it pay " basis. They would be equipment and measures necessary to make the allotted fuel ration perform its task. A paradox, perhaps, that a form of rationing and subsidy should be the means of reaching the sunlit uplands of Churchill's stirring promise. But why not?

If increases in price can be passed on, then reductions can be passed on likewise. Many industries have a " coal clause " or its equivalent to enable them to adjust the selling price of their product to suit variations in the cost of fuel. Most of these clauses are framed on the basis of relatively small variations, and they may require modification in the case of a large subsidy, to ensure that the benefit of lower costs is in fact passed on, and that the mechanism operates equitably. A substantial reduction in fuel prices, made as it were overnight, could speedily be translated into an immediate reduction in commodity prices. Power tariffs could be reduced with little delay. Steel would be cheaper very quickly. Transport and food prices should come down rapidly. Honest community co-operation could, in a few months, reverse the inflationary trend with enthusiasm.

Is it a dream? There would be objections; there always are. But in the scope of this Address it is not possible to examine them in detail.

I fear I must leave the suggestion there. We have ranged widely in our inquiry into the place of the technologist in general and of the fuel technologist in particular, in the modern scheme of things. We have urged that the technologist bears a moral responsibility for which he must more and more fit himself. To know how to do a thing, to know how to achieve a desired technological end, is no longer enough. The technologist must increasingly inquire into the why and wherefore of proposed action. It is not sufficient to quote classical precedents for doubtful expedients. Knowledge alone is no longer power; the knowledge of how to apply knowledge takes over the reins. The ultimate benefit of the community at large, whatever meaning we give to that phrase, demands the exercise of that greater power with a deeper and calmer humanity and wisdom.

Edinburgh Householders Satisfied

According to a survey published in July in the *Health Bulletin* of the Department of Health for Scotland, 84 per cent. of the householders in Edinburgh's Gracemount scheme are satisfied with their coke fires, despite occasional complaints of " sparking " and fumes.

THE 1956 ALKALI REPORT

92nd Report on Alkali, etc., Works, for 1956. By the Chief Inspectors. (H.M. Stationery Office. 2s. 6d.)

Perhaps the most significant thing which emerges from this latest Report is the increasing work of the Alkali Inspectorate. Production is vastly greater in a good many instances than it was before the second world war. Production of sulphuric acid has increased from 0·8 to 2·0 million tons per annum, cement production has virtually doubled from 6·5 to 12·5 million tons per annum and the throughput of crude and process oils at petroleum refineries has increased from 2 to 26 million tons per annum.

There have been increases in production of ammonia, man-made fibres, fertilizers, and in the amount of coal tar distilled. There has also been development of new industries, e.g. bromide from sea water and the manufacture of carbon black. In addition the provisions of the Clean Air Act relating to smoke, dust and grit from premises registered under the Alkali Act, and to burning colliery spoil-banks, will no doubt further increase the load on the Inspectors. All this with a staff of ten inspectors including the Chief Inspector for England and Wales (Dr. Carter) himself, and Mr. Damon, the retired Chief Inspector, in an advisory capacity. In the light of these facts Dr. Carter's remark that "The task of the Inspectorate has become more onerous," can only be regarded as a striking example of British understatement.

Turning to more specific points, it is of interest to note that during the year the average sulphur content of the gases from Bankside power station was 0·26 per cu. ft. of dry gas, and the average efficiency of the sulphur removal plant was 96·9 per cent. As Dr. Carter says, a very satisfactory state of affairs. The situation at Battersea, was however, not so satisfactory for a number of reasons, and the average efficiency was around 85 per cent.

Dr. Carter devotes considerable space to the problem of dust emission from cement works, after pointing out that this is one of the most difficult of any facing the Department and one which continues to receive particular attention. The complaint is widespread, but the problem is most serious in the Thames-side area where works are on both sides of the river between Dartford and Gravesend and where some four and a half million tons of cement are produced annually. The Report outlines the process of cement manufacture and some of the difficulties involved in the different methods of dealing with the dust. A point of interest is that at some small to medium-sized works dust emission has been brought below the level at which complaints arise by the application of high duty cyclones. Their efficiency is below that of an electric precipitator but they require less supervision and maintenance and can operate for long periods without attention.

Mist Formation

Another problem of concern to the Inspectors is that of mist formation from certain industrial processes, which has become more pronounced in the post-war years. The mass emissions concerned are usually trivial by normal standards and in most cases, but not all, probably harmless. There is, however, appreciable and often justified complaint against the mists and fogs rolling from the works concerned, says Dr. Carter. He goes on to say "Means of treatment are often difficult and costly and if the trouble can be dealt with at source it would be of major assistance. In any case reliable and fundamental research on the whole matter of mist formation is needed. The matter has been brought to the notice of Department of Scientific and Industrial Research and discussions are continuing. Meantime there is no relaxation of effort to find a solution to the particular

cases under investigation."

Coke Ovens

Dealing with coke ovens and gas works, the Report says that coke ovens receive routine visits, as processes for the working up of by-products are registrable, but Inspector's powers do not extend to the various operations productive of smoke, " green gas " and grit emissions, e.g., charging of coal to the ovens or quenching of hot coke. Nevertheless as a result of the Department's long-standing interest in means for reduction of emissions from coke ovens it is now the normal practice for inspectors to discuss these matters with coke oven managers on the occasions of such routine visits. The Department has for some years been anxious that all new coke oven batteries be equipped with double gas collecting mains. In many cases these have been fitted, but there are a number of coke oven managers who are reluctant to adopt the practice.

It is almost impossible to operate coke ovens with complete absence of grit and fume emission even when the plant is fitted with the most modern devices for countering pollution. At certain low temperature carbonization works considerable progress had been made by the research and development team on means for the suppression of fume during charging and discharging of retorts and trials had been made with prototype equipment. Much remained to be done before complete solutions to the many difficult problems involved were available. However, as Dr. Carter says: " it is good to know that the industry is diligently searching for means to enable it to be as good a neighbour as possible."

Scotland

The Report of Mr. Balfour Birse, the Chief Inspector for Scotland, also contains a reference to trouble in the form of mists emitted from factories, in this case from plants for the granulation of chemical fertilizers. These mists, which are primarily due to the volatilization of hygroscopic substances in drying the granulated fertilizers, are unpleasantly persistent and troublesome, particularly in humid weather conditions. They have a characteristic smell and tend to deposit a white film on exposed surfaces such as windows. The degree of mist is generally related to the temperature of drying in a way which suggests that the higher the temperature of drying, the more there is volatilization of hygroscopic substances. A practicable method of abating the mists at their source is being sought. Mr. Birse notes that in his report for 1955 he referred to a method of treatment which had been developed from a pilot scale plant to a full scale one and was showing promising results. He states that from personal observations of this plant and local reports there is every reason to believe that the method is successful although it would not necessarily eliminate the need for a higher point of discharge than that usually adopted at works for the granulation of fertilizers.

High Efficiency

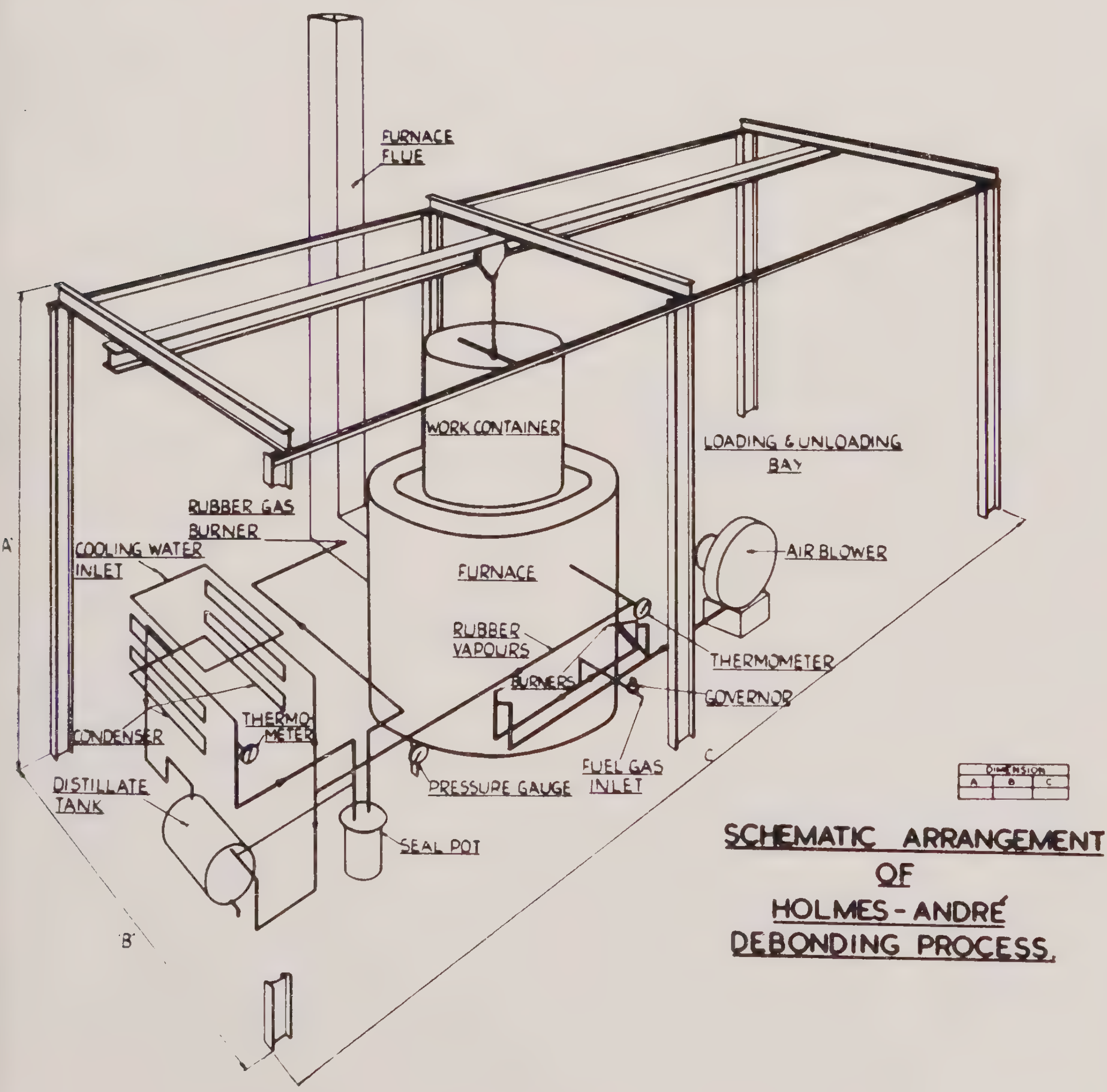
Simon-Carves Ltd., have issued a leaflet on the achievement of their coal-dust electrostatic precipitators installed in the Aberaman " Phurnacite " plant of the N.C.B. The precipitators incorporate a highly efficient chute-type of receiving electrode, which is designed to slide the attracted dust down to the collecting hoppers and prevent it from re-entering the gas stream when the electrodes are rapped. With a 25 per cent. overload on design conditions, a collection efficiency of no less than 99·93 per cent. was obtained during the official acceptance tests. The average efficiency over four tests was 99·85 per cent. This is remarkably good, and the leaflet does well to point out that the difference between 99·94 and a mere 99·0 per cent. collection is that for every grain of dust that escapes with the former figure, 16 escape with the latter.

A PROBLEM OF RUBBER SMOKE & FUMES

A new de-bonding process

The manufacture of components in which rubber is bonded to metal has increased considerably during the past fifteen or twenty years, and most rubber companies are now actively engaged in meeting the demands of this expanding market.

There can be little doubt that the bonding of rubber to metal is a sound commercial proposition—in the United Kingdom alone several million bonded components are produced monthly. Out of this considerable output there is almost certain to be a percentage of defectives which, although small, is not insignificant. As might be expected the value of the metal part is usually a substantial proportion of the total cost of the component, and is more often than not the property of the rubber company's customer. Quite naturally, the customer expects most of his metal parts to be bonded satisfactorily, but knowing that a number of defectives are almost inevitable he usually supplies a few parts in excess of his requirements. If this precaution is not taken with small orders for relatively expensive items it may be quite impossible to obtain the few parts required to complete the order at an economic price.



SCHEMATIC ARRANGEMENT OF HOLMES-ANDRÉ DEBONDING PROCESS.

The need to salvage metal parts is therefore of prime importance. Various methods have been adopted in the past, but these have been expedients rather than technical processes. There is for example the commonly used " bonfire " method. This method is rather primitive and has many disadvantages; it is difficult to control and may result in losses due to distortion caused by over-heating; losses may also occur as a result of pitting caused by sulphurous acid attack in inclement weather. Another major disadvantage associated with this method is the inevitable pall of smoke which will almost certainly infringe the requirements of the Clean Air Act.

Special rigs for melting the bond by gas flame or by electrical induction heating are one stage better technically, but involve considerable handling costs and do nothing towards solving the smoke and fume problem.

Chemical de-bonding methods are limited in their application, slow in operation and often require considerable preparatory work involving removal of the bulk of the rubber by cutting or buffing to obtain the necessary intimate contact between solvent and bonded surface.

Any review of available de-bonding methods must lead to the conclusion that the destruction of the bond by heat has the virtues of simplicity, universal application and rapidity of action. In order to eliminate the disadvantages inherent in the combustion method, a process has been developed by the Chemical Engineering Division of W. C. Holmes & Co. Ltd. of Huddersfield. This process, which is to be known as the Holmes-Andre De-bonding Process, is based on the principle of destructive distillation in a closed vessel in the absence of air, a technique well established in industries such as coal gas manufacture, and charcoal production. A de-bonding plant of this type has been in operation at the factory of a well-known rubber company in the London area for the past seven months, and is giving every satisfaction in the reclamation of metal parts. No fumes or smoke are emitted and the plant is quite acceptable for operation in the residential area surrounding the factory.

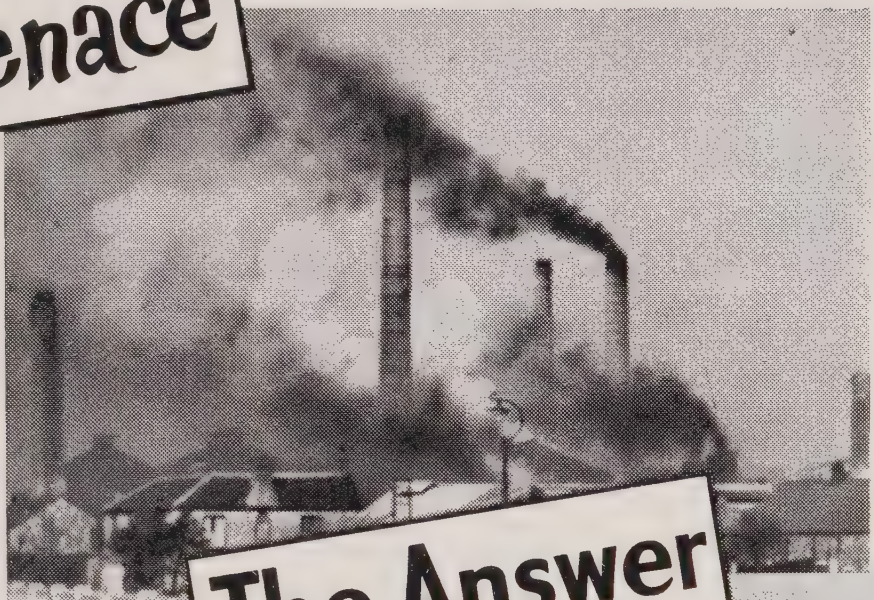
The charge of components weighing 10-15 cwts. is loaded into a container and thence into a vertical cylindrical retort, the cover of which is sealed down. A gas-fired furnace provides the heat necessary to distil the rubber, the process taking approximately seven hours during which the temperature is not allowed to exceed 500°C. The products of distillation are gaseous, liquid and solid; the two former being separated by cooling the hot vapours leaving the retort whilst the solid product is a carbonaceous residue left in the container.

At present the gaseous products are burned in the furnace stack although it is intended to divert these into the furnace thus effecting an economy in the consumption of towns gas. The liquid product is a thin tar, somewhat evil smelling, but with a high calorific value. For the time being this is being disposed of by mixing it with the works boiler fuel oil, but research is proceeding towards utilising it for heating the furnace setting.

The metal parts remaining in the container are easily cleaned by a relatively mild barrel tumbling process, the carbon residue being quite acceptable for disposal by the normal method.

The Combustion Engineering Association is to hold a conference on 5th and 6th November, at the Old Swan Hotel, Harrogate, for the purpose of examining the third annual report of the National Fuel Efficiency Service and analysing the findings of N.I.F.E.S.' engineers in their work with industry. It will also highlight the inefficiency which has been found in the use of fuel and show where the greatest savings may be made. Particulars of the conference may be obtained from the Association at 6 Duke Street, St. James's, London, S.W.1.

The Menace



Two pictures which show the vital part the Oldbury Stoker is capable of playing in the campaign for cleaner air. (Above) a typical industrial district; (below) an Oldbury-equipped factory operating on full load burning a cheap local slack

The Answer

OLDBURY CHAIN GRATE STOKERS:—

- Assure completely smokeless combustion.
- Provide a simple, positive — and PROFITABLE—method of complying with the Government's Clean Air Act.
- Maintain full boiler output with poor or widely varying fuels.
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The Oldbury "Minor" for cast iron and steel sectional hot water boilers has the same ability to deal efficiently and smokelessly with low-grade fuels as its larger counterpart; the same reliability and low maintenance costs.

Clean Air

by

OLDBURY

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Smokeless combustion with practically any type of solid fuel.

Send for Publication No. 1618—Oldbury Stoker.

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Not long surely, for smokeless coke and gas will provide heat

for any purpose more efficiently and economically.

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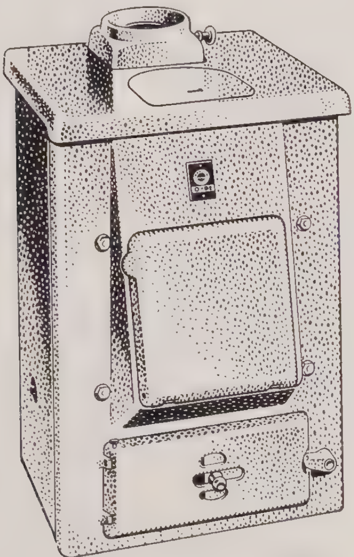

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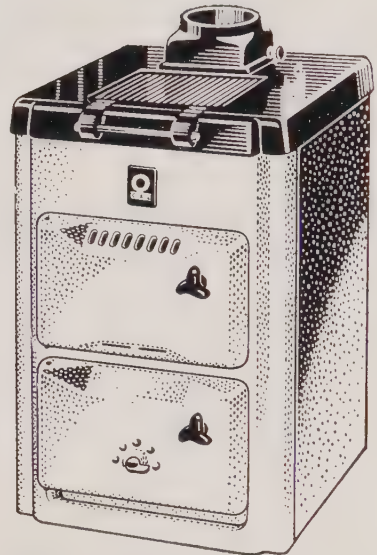

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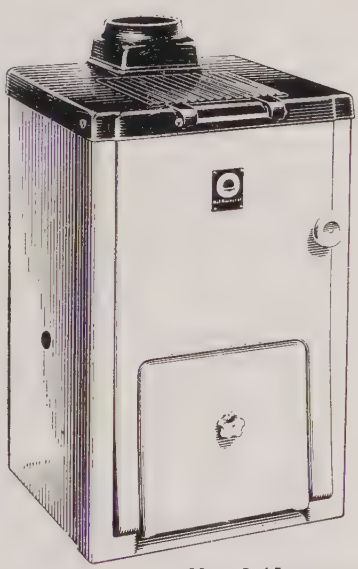

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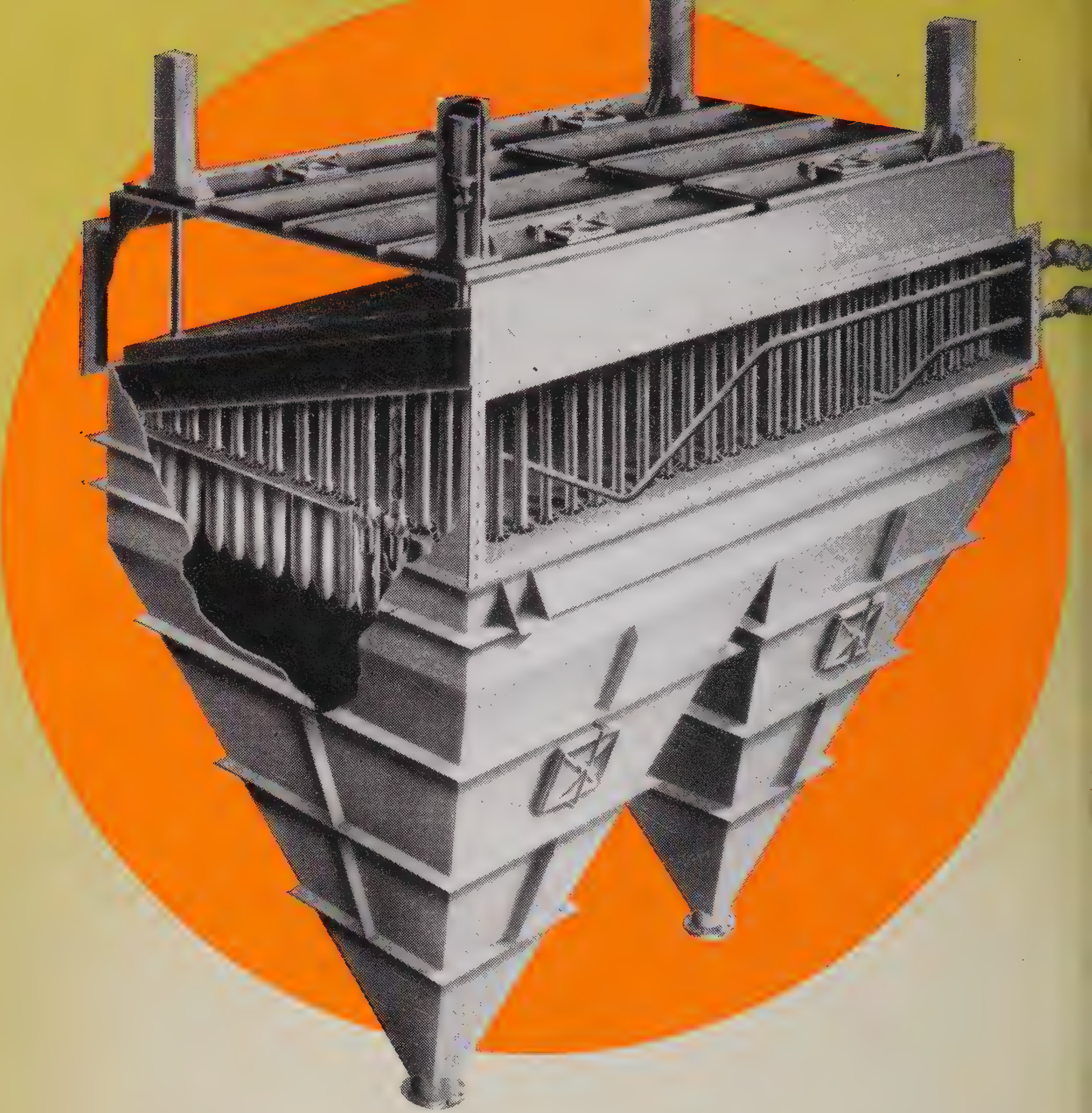


SMOKELESS AIR

JOURNAL OF THE
NATIONAL SMOKE ABATEMENT SOCIETY

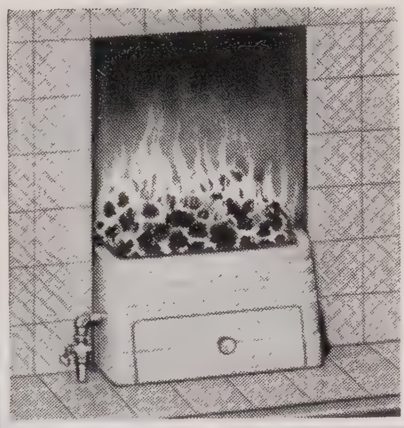
No. 104 ⋆ WINTER 1957 ⋆ 2/-

In this Issue

Greater Comfort for the Smaller Home

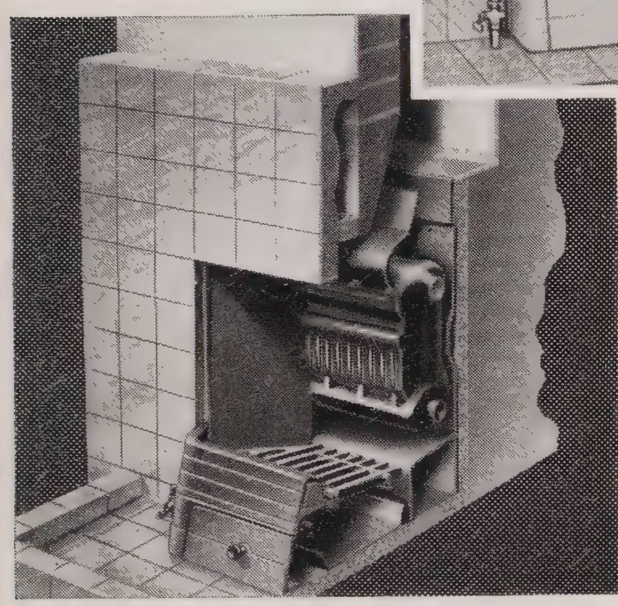
IDEAL NEOFIRE No. 2C

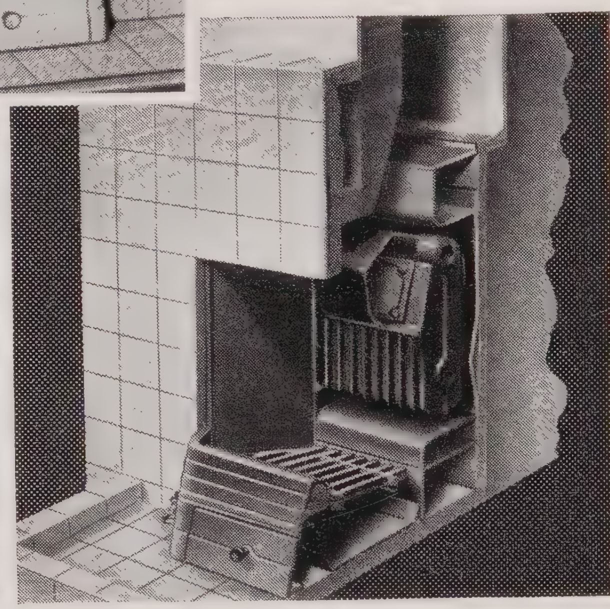
British Patent No. 591977



IDEAL NEOFIRE No. 10

British Patent No. 753719





The Ideal No. 2C Neofire is a cheerful open fire, backed by a boiler specially designed to provide the combination of Domestic Hot Water Supply and Background Heating. The boiler will heat up to 3 radiators in other parts of the house, and the domestic supply is obtained by the 'Indirect' method, which entails the installation of an Ideal *Indirect* Cylinder of appropriate capacity.

The Ideal No. 10 Neofire is primarily designed for Direct Hot Water Supply, with a cylinder of not less than 30 gallons. The boiler can be Bower-barffed (rust resistant treatment) for use in soft water districts.

In hard water areas the No. 10 Neofire can be installed to provide both Domestic Hot Water *and* Background Heating.

Each Neofire has a boiler of sufficient power to take care of approximately 40 square feet of radiation, plus an average amount of piping, and to provide hot water for all domestic purposes with a cylinder of 20 gallon nominal capacity. Though primarily designed to burn coke, Ideal Neofires will also burn coal, anthracite or special fuels; they consume approximately 2 lb. per hour, utilising up to 60 per cent of the heat contained in the fuel, compared with 15-20 per cent by the ordinary open fire.

Standard colours are Cream Mottle, Black, Copper Lustre.

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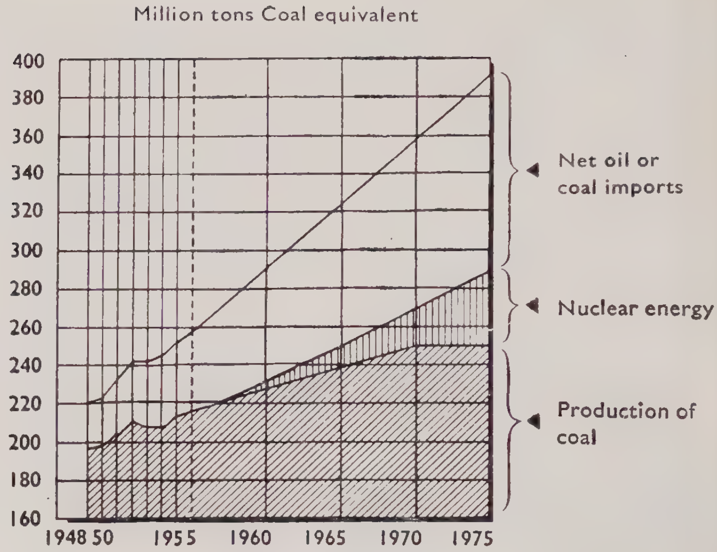
328B

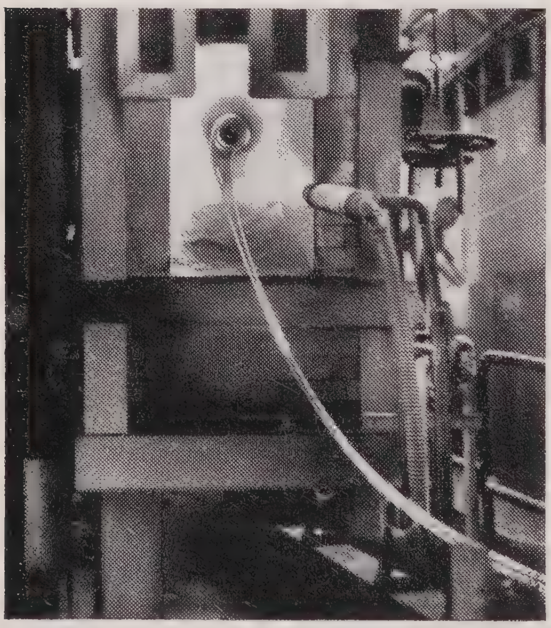
CLEAN AIR MEANS INCREASED PRODUCTIVITY



This graph shows the forecast 'fuel gap' which Western Europe is expected to face as published in Fuel Economy Review 1956. It emphasizes the need to make the best use of the nation's coal.

IT was not until the Egerton Report on 'Heating and Ventilating' and the Simon Report on 'Domestic Fuel Policy' that a public interest in clean air was expressed officially. The Ridley Report in 1952 followed, and then came the Beaver Report on 'Air Pollution' in 1954 which initiated the existing Clean Air Act.

The Beaver Committee said that within fifteen years the nineteen million tons of raw coal being burnt in the black areas must be replaced by smokeless fuel. Simultaneously, with events leading to the Clean Air Act, successive Fuel Ministers have urged the domestic and industrial fuel user to use his fuel more efficiently; a need which was emphasized by the Suez crisis.



Gas is an indispensable fuel for the economic production of glass in Britain.

The fuel experts of the Organisation for European Economic Co-operation expect a 'fuel gap' between estimated fuel supply and anticipated demand throughout the next twenty years at least. This, together with the rising cost of fuel, makes it essential for both national and economic reasons that the best possible use is made of every ton of coal.

Yet, the problems of clean air and fuel efficiency are intimately associated said a Parliamentary Secretary to the Ministry of Power (David Renton, Q.C., M.P.): "fuel efficiency and clean air are as inseparable as Siamese twins".

Whereas other countries have *had* to be fuel conscious because coal was an expensive import, British Industry and Domestic Heating have developed on cheap and plentiful coal supplies. And this has led to profligate waste.

Gas and Coke

A Special Study of Domestic Heating in the United Kingdom (Present and Future) was made in a Conference held in 1956. The objects were :—

(1) Reduced heat losses from houses by good insulation, draught prevention and reduced flue losses.

(2) Higher efficiency appliances suited to the design of the house (including central heating).

(3) Appliance efficiency in different circumstances confirmed by field tests in actual dwellings.

(4) A national policy relating to supplies of fuel and energy.

Of the various fuels—liquid, gaseous and solid—the brunt of the smokeless heat load must be carried by the Gas Industry's coke.

The Gas Industry processes coal in its carbonisation plants at an efficiency of about 75% or more, whereas the efficiency of coal usage on the open stool-bottomed grate employed in millions of homes in this country, is in the neighbourhood of 15% to 20%.

The Gas Industry produces town gas and coke as refined smokeless fuels. It harnesses the smoke-producing components of coal as coal tar, which is processed to obtain benzene, xylene, napthalene, phenols, etc., indispensable to Britain's organic chemical industry. Pitch gives road-making materials and bituminous paints. Ammonia products make fertilizers.

Thus, the Gas Industry is a chemical engineering industry using coal to produce two smokeless fuels—gas and coke—together with many vital chemical by-products.

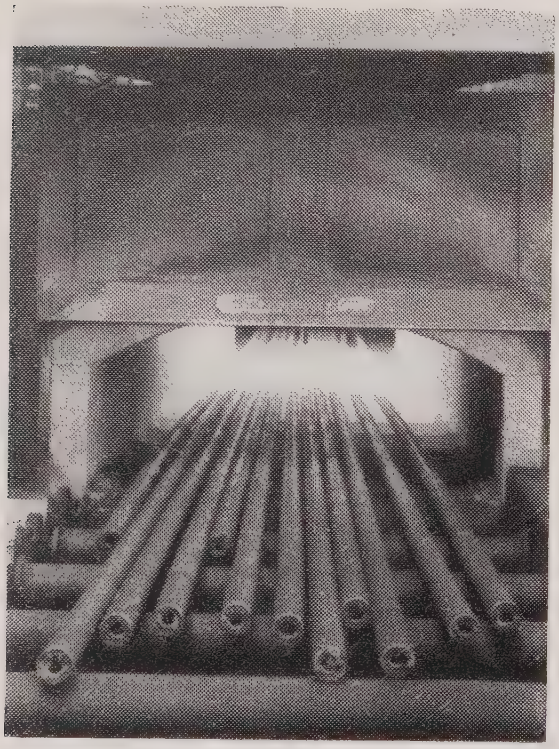
Both gas and coke are indispensable in the implementation of the Clean Air Act.

Gas is delivered to the point of use and costing requires only a meter reading. It incurs no handling costs. No transport deliveries. No storage costs. No variations in the calorific value.

In an urban area where factory extensions are controlled, storage space is valuable. Stokers or attendants are not needed in cases where boilers fired by gas incorporate a clockwork device which is pre-set for operation.

The Fuel Research Station has shown that a modern open fire using coke throws 25% more heat into the room than when a similar weight of good quality bituminous coal is used.

The Gas Industry *does* make the best use of the nation's coal.



Gas plays an important part in the production of boiler tube. Tube is seen entering a 90 ft. gas-fired annealing furnace operating at 950°C.

Gas in Industry

The Gas Industry supplies gas for something like 4,000 different industrial processes and trade usages. During the years it has acquired a great knowledge of many of these processes. This knowledge has been correlated, tabulated, filed and is available to any gas user. The Industrial Gas Engineers in the Area Gas Boards can draw upon the combined knowledge of all their colleagues all over the country, this being part of the Gas Industry's comprehensive Industrial Technical Service. This service is free, authoritative and impartial. Industrial Gas Engineers work in close confidential co-operation with many manufacturers to evolve new special purpose equipment. Many are the examples where they have increased productivity and reduced fuel consumption; and, of course, expanding use of gas in industry means cleaner air.

The Gas Industry has always paid close attention to the equipment used, and to this end it maintains a comprehensive list of accredited appliances and equipment. Its Research and Development departments test new gas and coke-fired equipment scrupulously.

Undoubtedly a consultation with the engineers at an Area Gas Board is a worthwhile, costless investment.

References:

Scottish Gas Board, Edinburgh
Northern Gas Board, Newcastle-upon-Tyne
North Western Gas Board, Manchester
North Eastern Gas Board, Leeds
East Midlands Gas Board, Leicester
West Midlands Gas Board, Birmingham
Wales Gas Board, Cardiff
Eastern Gas Board, London, S.W.1
North Thames Gas Board, London, W.8
South Eastern Gas Board, Croydon
Southern Gas Board, Southampton
South Western Gas Board, Bath
The Gas Council, 1 Grosvenor Place, London, S.W.1

Issued by the Gas Council

THE GAS INDUSTRY MAKES THE BEST USE OF THE NATION'S COAL

Clean Air Publications Available from the Society

(Prices quoted include postage)

Published by the Society

Clean Air Year Book—1s. 10d.
Summary of the Clean Air Act—6d.; 4s. 6d. per 12; 30s. per 100.
Smoke Control Areas (Article reprint)—4d.; 4s. per 12; 12s. 6d. per 100.
The Prevention of Grit and Dust Emission, by C. J. Stairmand—1s. 2d.
Southport Conference Proceedings—12s. 11d.
Hastings Conference Proceedings (*ready shortly*)—12s. 11d.
Hastings Conference Reprints:

- Meteorology and Air Pollution (Des Voeux Lecture), by Sir Graham Sutton—1s. 2d.
- The Operation and Maintenance of Road Vehicles to Minimize Air Pollution, by H. E. Styles and A. T. Wilford—1s. 2d.
- Industry and the Clean Air Act, Papers by Leslie A. W. Jenkins and Dr. W. A. Macfarlane—1s. 2d.

Leaflets: Facts About Smoke—14s. per 100; £6 10s. per 1,000.
They Didn't Know What to Do—4s. per 100; 30s. per 1,000.

Posters: Colour Posters, 30″ x 20″—1s. 11d. each; 6 copies or more 1s. 9d. each.
Small Posters, 20″ x 15″—6d. each; 6 copies or more 5d. each.

Official Publications (H.M.S.O.)

The Clean Air Act—1s. 11d.
Memorandum on Smoke Control Areas—1s. 5d.
Memorandum on Miscellaneous Provisions of the Clean Air Act—10d.
Clean Air Act: Model Building Byelaw—4d.
Smoke Control Areas (Authorized Fuels) Regulations, 1956—4d.
Report of the Beaver Committee on Air Pollution—2s. 10d.
92nd Report on Alkali, &c., Works, for 1956—2s. 10d.

Text Books

The Law on the Pollution of the Air and the Practice of its Prevention, by J. F. Garner and R. S. Offord—30s. 11d.
Atmospheric Pollution, by A. R. Meetham—64s.
Smoke: The Problem of Coal and the Atmosphere, by Arnold Marsh—21s. 10d.
Air Pollution Handbook, ed. Magill *et al.* (U.S.A.)—£5 14s. 6d.
Boiler House Practice, by J. N. Williams—61s. 9d.

Ringelmann Charts (Griffin)—2s. 6d. per 3; 4s. 2d. per 6; 7s. 2d. per 12.

National Smoke Abatement Society

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SOUTH WALES and MONMOUTHSHIRE: A. J. Dalton, A.M.I.E.E., S. Wales Electricity Board, St. Mellons, Cardiff (St. Mellons 600).

MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership application form will be sent on request.

AIR POLLUTION NEWS

The Society's new Bulletin, published as required for the purpose of providing members and others with up-to-the-minute news of importance on all aspects of air pollution and the campaign for clean air.

APN will be sent free of charge to members and representatives of members *on request*, and to others on payment of postages account.

SMOKELESS AIR

Vol XXVIII No. 104 Winter 1957

Principal Contents

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SMOKELESS AIR is published quarterly by the National Smoke Abatement Society at Palace Chambers, Bridge St., London, S.W.1. Tel: TRAfalgar 6838-9 (Editorial and Advertising). Issued gratis to Members and Representatives of Members. Subscriptions rate for SMOKELESS AIR only, 8s. per annum, post-free.

Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

N.S.C.A.

On 1st January, 1958, the National Smoke Abatement Society will formally become the National Society for Clean Air. Approval has been given by the Board of Trade for the Society to become a Company limited by guarantee and dispensing with the word " Limited " in its title. This approval can be regarded as a kind of charter, and is given only to bodies that have, over a period of years, shown themselves to deserve the privilege.

Copies of the Memorandum and Articles of Association in their final form are to be printed and will be available to members. Members are asked to note that they will be asked to sign a membership application form for the new Society as required under the new constitution. This form will be enclosed with the customary subscription reminder form as subscriptions fall due, month by month, during 1958.

Fuel Efficiency and Clean Air

ON another page is a report of the recent conference on air pollution in the iron and steel industry. The range and quality of the papers given is a clear indication of the determined way in which this important industry is getting down to meeting the responsibilities placed upon it by the Clean Air Act. There is a great deal to be done before these responsibilities are fully discharged, but an encouraging start is being made.

Also of considerable interest was the conference of the Combustion Engineering Association at Harrogate early in November, which met to discuss, criticize and analyse the 3rd Progress Survey of the National Industrial Fuel Efficiency Service, which is reviewed on another page. The conference was attended by producers, distributors and users of fuel, the makers of appliances and equipment, and representatives of N.I.F.E.S. itself. Full and fruitful discussions were held and from them emerged, among other conclusions, two lines of thought that are of major interest to those whose primary concern is clean air.

In the first place the conference was very much alive to the evidence, so well revealed by the N.I.F.E.S. report, of the vast amount of fuel wastage still prevailing in this country. The first-class work being done by N.I.F.E.S. was recognized, but even at a much faster rate of progress it will take many years to bring fuel usage in general up to even the average efficiency of today. The conference was concerned about the problem of how to overcome the apathy that exists over wide sections of industry. Among other means to break down this apathy the conference wondered how much the Clean Air Act would help. It did not attempt to answer the question—which of course as yet no one can answer—but there was, implied if not expressed, a

hope that the Act would prod the inefficient fuel users into action. Local authorities should be pleased to know of this attitude, so that when before very long, they are able to start to administer the Act in full, they will be able to feel that firmness with those who are making dark smoke by wasting fuel will be applauded by the more enlightened sections of industry.

Boiler Operators

The second encouraging sign, noted at this conference, was the wide measure of support, again to promote fuel economy, for the training and certification of boiler operators. This even included much, if not entire, support for *compulsory* certification. Compulsory certification, it will be recalled, was urged, without success by the Society for inclusion in the Clean Air Act, and it is now considering the possibility of legislation for this purpose alone. It is encouraging to learn that such a measure would find support among many of those who are pressing for more effective action to promote fuel efficiency.

Windscale

On the face of it a National Society for Clean Air should be concerned about the hazards that may arise from atomic energy processes and related activities. The Windscale accident is a case in point. Examination of the question, however, does not show how such concern could be applied in practice. Pollution of the atmosphere by radioactive matter is very different from other forms of pollution in that neither public opinion nor (when it is required) official action, needs stimulation. The Windscale incident, and the inquiry which so promptly followed, shows that if and when something unforeseen occurs, measures to deal with it and prevent its recurrence are taken at once, even when, as in this case, no harm was done other than some disturbing but temporary contamination. No one can say that other accidents cannot happen, but the additional precautions now being taken must make them much less likely.

It is important to notice that Windscale is quite a different kind of plant from the electricity generating stations that are to run on atomic energy. With the latter there can be no discharge, even accidental, of radioactive gases into the air. As the drawing on another page shows, there is not even a chimney at such stations. Windscale is not a power station; it is more in the nature of an ordnance factory, where experimental work was also being carried out. Given the most stringent precautions at such establishments—which we can now expect—and the fact that generating stations cannot pollute the atmosphere we are left only with the world-wide contamination of the atmosphere due to the testing of nuclear weapons by the three great powers. This pollution, though gradually growing, is still well below the level of the safety standards that have been laid down, but there is understandably a widespread disquiet, mixed with political views and emotions that take the question well out of the simple field of clean air. The radioactivity from this source, as well as that experienced locally in Westmorland recently, are still well below the increase in radioactivity, from the combustion of coal, that occurs during a dense smog. And, as far as we know, that concentration is of minor importance compared with the more familiar smoke, gases and fumes.

Personal

Dr. R. Lessing.—The Society's President was recently honoured by the Faraday Society by being elected as an Honorary Life Member and re-elected as a Vice-President.

Sir Ernest Smith.—The resignation as Hon. Treasurer of the Society of Sir Ernest Smith is announced elsewhere. He has also resigned from the Chairmanship of the Industrial Coal Consumers' Council, an office he has

held since the council was formed ten years ago. In a letter to him, Lord Mills, Minister of Power, says: " That the council has won general recognition and has made a real contribution to the shaping of policy and the settlement of many problems is in a large measure due to your wise leadership.'

C.U.C.

Congratulations to the Coal Utilization Council on their 25th birthday, and on the notable convention they organized to celebrate the occasion. It would be incorrect to say that the C.U.C. and this Society have always seen eye to eye, especially in the early days, when somewhat divergent views were held about the future of the open coal fire. But the Council has moved with the times, and today is doing good work in helping those who, though wanting to continue using solid fuel, wish to use it economically and with an eye to the day when their homes will be in a smoke control area. Possibly even more valuable is the work the Council is doing throughout the country in training and educating appliance distributors and fitters. It is another side of the fuel efficiency campaign that is smoothing the path for clean air.

Money for Smog !

A group which calls itself the Los Angeles Smog Corporation is reported to have given a demonstration in Los Angeles on how to can, label, package and store smog. Charleton Young, president of the concern, says he will sell " pure " Los Angeles smog through souvenir wholesalers and retailers.

THE SOCIETY

At the Annual General Meeting at the close of the Hastings Conference, the results of the annual elections were announced. Dr. R. Lessing was re-elected President, for the second year of office allowed by the constitution. The existing Vice-Presidents were re-elected, with four new names added: Alderman Dr. C. A. Bence, Councillor Eric Gibbons, Mr. John Innes and Mr. F. J. Redstone.

The announcement that Sir Ernest Smith had been re-elected as Hon. Treasurer had, unfortunately, to be coupled with the news that since nominations had closed the state of his health had made it necessary for him to resign from office. This news was received with the greatest regret, and it was agreed that the sympathy of the meeting, and good wishes for Sir Ernest's recovery be sent to him, together with an expression of appreciation for all his many valuable services to the Society.

The meeting agreed that the Executive Council should appoint an Acting Hon. Treasurer to take office until the next annual elections. At the next meeting of the Council an invitation was extended to Mr. Stanley E. Cohen, C.C., who, we are pleased to be able to announce, was able to accept the position. Mr. Cohen is a member of the Common Council of the City of London, and until recently was Chairman of its Health Committee. As such he played a leading part in the establishment of the City as a smokeless zone, and much of the success of the operation can be attributed to his personal interest and keenness.

The Executive Council has elected Dr. J. S. G. Burnett, Medical Officer of Health for Preston, as its new Chairman to succeed Mr. F. J. Redstone. Mr. John Innes was re-elected as a Deputy Chairman, and Dr. J. L. Burn was elected as a new Deputy Chairman in place of Dr. Burnett.

The election of Divisional representatives to the Council was marked by only one change. This was in the Scottish Division, where Mr. John Page (Kirkcaldy) takes the place of Mr. J. F. Anderson (Edinburgh), who has now retired.

Hastings Conference

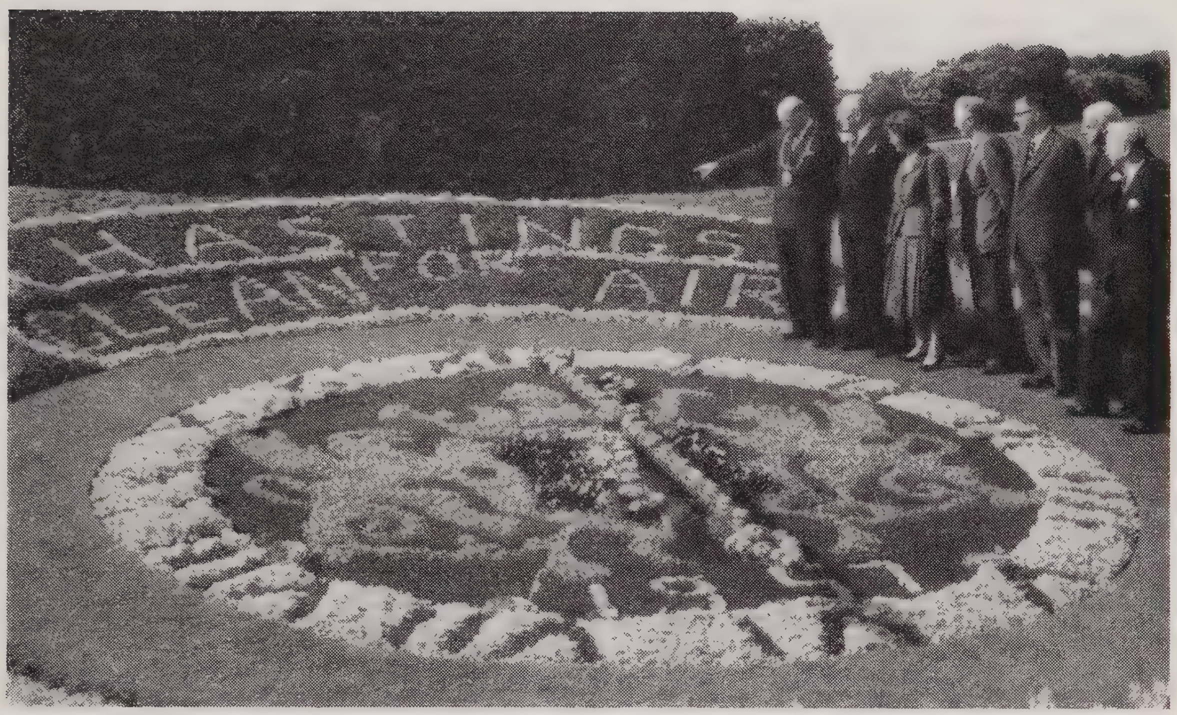
Record Attendance

MORE serious than usual and with a greater feeling of responsibility, was the approving verdict of a number of delegates to the Society's conference at Hastings on 2nd to 4th October. It is true that there were few of the fireworks that amuse a conference for the moment, serving as light relief, but it would not be true to say that the atmosphere of the conference was in any way a heavy one. Perhaps there was a feeling that we were at a point of change where it was not possible either to cheer what was being done or rail against what was not being done.

Although a few of the seven hundred delegates—a record number—were prevented from coming because of Asian 'flu, the conference was a cheerful one, if only because for the whole time Hastings was bathed in warm autumn sunshine—to the obvious gratification of the Mayor, Alderman Hussey, whose friendly interest in our proceedings and well-being was maintained from start to finish. The White Rock Pavilion was ideal for a conference of our size, and its sound amplification system was unusually good.

The quality of the opening session of a conference seems to pervade all the subsequent meetings, and on this occasion it left nothing to be desired—a charming greeting by the Mayor, a

Lord Mills addressing the Hastings Conference. Also at the table, left to right, are Mr. G. W. Farquharson, Alderman Dr. F. E. Tylecote, Councillor G. H. Tanner (Chairman, Hastings Hygiene Committee), Mr. F. J. Redstone, the Mayor of Hastings, Alderman Hussey, the President (masked by the Minister), Dr. J. S. G. Burnett and Dr. T. P. Colclough



The Mayor showing the topical floral clock—"Hastings for Clean Air"—to a party that includes the President, Mrs. Redstone, Councillor Tanner, Mr. Redstone, Mr. Marsh and Dr. Burnett

well-reasoned Presidential address by Dr. Lessing, which interestingly glanced back to the early days of the Society and probed into the future, and then the address by the Minister of Power, Lord Mills, which appealed to all with its thoughtful, firm, and well-balanced approach to the linked problems of fuel policy and clean air.

At the Wednesday afternoon session the problems of pollution from road vehicles were discussed in an informative technical paper by Mr. Styles and Mr. Wilford of the London Transport Executive, and in a paper on the control of such emissions by the Chief Constable of Hastings, Mr. Archer-Burton. This paper had been submitted for information to Chief Constables throughout the country, so that from the point of view of drawing attention to the problem—one of the functions of the conference—a most useful job had been done by the author himself.

Thursday morning brought the papers on the administration of the Clean Air Act by Mr. Lindsay Taylor, Town Clerk of Tottenham, and Mr. Graham Don. Mr. Taylor spoke from the viewpoint of an officer concerned with the administration of the Act as it is; Mr. Don spoke as an independent person, and perhaps some of his provocatively stated points warrant closer examination than the discussion, good though it was, could provide. Included with these papers was a report, prepared by the Director for the Executive Council, on the present position of smokeless fuels in relation to smoke control areas.

Industry's reactions to the Act were discussed at the afternoon session: Mr. Leslie Jenkins, speaking as an industrialist, and Dr. Macfarlane, Chief Executive of N.I.F.E.S., both contributing papers which again call for further study. The papers were ably supplemented by a programmed opening to the discussion by the President of the Institute of Fuel, Mr. John Rylands. One felt that everyone present learned a great deal about the problems and attitudes of industry—the session was in fact an excellent example of the unique way in which this Society brings together all interests and points of view.

The Des Voeux lecture on Friday

morning, on " Meteorology and Air Pollution," was received with a mixture of disappointment that its author Sir Graham Sutton, was unable to be present, and of delight in the interesting way in which it was presented by his Deputy, Mr. P. J. Meade.

The proceedings closed with the annual business meeting, which among other things approved the Statement on the Training of Boiler Operators recorded on another page, and passed a formal resolution agreeing that the National Smoke Abatement Society be dissolved on 31st December, 1957, and its assets transferred to the new National Society for Clean Air.

The meeting heard, and approved, an invitation from the Chairman of the Council of Llandudno, to hold the 1958 conference in that town. The dates will be 1st, 2nd and 3rd October.

Finally, a word should be said about the social events. The informal " get together " at the Queen's Hotel on the Tuesday evening, before the conference opened, was again very popular and well worth arranging. The following evening saw the reception at the White Rock Pavilion by the Mayor and Mayoress of Hastings, whose warm hospitality and friendly informality were greatly appreciated. There was dancing for those who wished to dance, and an unusually good and entertaining stage show. As the accompanying photograph shows, the Society's emblem of John Evelyn, earlier in the day the background to a serious and dignified platform, looked down on a carefree, and apparently sylvan scene. Evelyn, it will be remembered, wrote *Sylva*, about trees as well as *Fumifugium*, about smoke. It was pleasing to see him framed in such a leafy bower.

Quotes from the Conference

By its discussions, publications, advice and services, and by peaceful persuasion of authorities and individuals, our Society can justly claim to have prepared the ground for the effective working of the new legislation. It deserves all the material help needed to maintain its useful position as an independent body ever watchful of developments, and to strengthen it for the tasks ahead. Let those in the Society's debt come forward to honour their obligations.—*Dr. R. Lessing, Presidential Address.*

* * *

I can recall in my very early married days my wife handed me the garden spade, and then she went back into the house, and the poor girl thought that the digging question was settled. That is more than twenty years ago, and the digging question has made astonishingly little progress. I am suggesting to you that the Clean Air Act is only a tool. It is a tool which has to be used vigorously and with imagination if we are ever going to get the clean air which the Mayor of Hastings advertises. — *Mr. Graham Don, introducing his Paper.*

* * *

As Head of the National Meteorological Service I can give a very wholehearted assurance that we shall do everything in our power to help the Society in its most praiseworthy crusade for a clean atmosphere.—*Sir Graham Sutton, in the Des Voeux Memorial Lecture.*

* * *

In the nuclear age must one now look ahead to the days of the atomically propelled road vehicles? When this day comes the lot of the policeman armed with a Geiger counter, may be a happier one.—*Mr. James R. Archer-Burton, Chief Constable, Hastings.*

* * *

The realization that smoke emission is a sign of gross inefficiency is growing

The Society's emblem—John Evelyn—in an unusual setting

steadily and the Clean Air Act in this respect can indirectly play an enormous part in raising the overall efficiency of fuel usage. Thus if industrial management will look upon the Act as a means of achieving higher plant efficiencies the implementation of its requirements will be doubly beneficial.—*Mr. Leslie A. W. Jenkins*

* * *

Indifference to fuel efficiency has run parallel to indifference to atmospheric pollution. We have been called the champion fuel-wasters of Europe, and seem to have rather gloried in the title. Perhaps the indifferent ear heard only the first half of the title—"champion"—and was deaf to the character of the championship.—*Dr. Angus W. Macfarlane.*

* * *

Really satisfactory progress depends in short, on local authorities planning smoke control areas on a scale which, because they threaten to cause a real shortage of smokeless fuel, may have to wait for some years before they can be established. It is quite wrong for local authorities to defer their plans for smoke control areas until the supplies of smokeless fuel are more certain. Orders will not be given Ministerial approval unless fuel supplies are adequate, and a long queue of such Orders waiting for approval is perhaps the best way of ensuring that production is being continuously expanded.—*The Director's report on Availability of Smokeless Fuels.*

Is Peter Simple?

"The time will come," predicted Lord Mills cautiously "when this country's towns and cities will be all bright and glittering in the smokeless air."

And when did he say this? At the 24*th annual conference* of the National Smoke Abatement Society. No doubt an equally rash and visionary statement will be made by another Minister of Power to the next generation of this dynamic, forceful, fast-moving society, at its 48th conference. Meanwhile, carry on coughing.—*Peter Simple, in the "Daily Telegraph."*

Address to Hastings Conference

by

The Minister of Power, Lord Mills, K.B.E.

IT gives me great pleasure to be with you at this Conference this morning and it gives me particular pleasure to be with your President, Dr. Lessing. Dr. Lessing is, if you will forgive my saying so, one of the grand old men of the Clean Air movement. His association with the Coal Smoke Abatement Society of London began nearly half a century ago, and even before that he was already engaged on research and consulting work of great importance for clean air. He is expert in many aspects of the problem, and long may this Society and the country as a whole enjoy the benefit of his wisdom and experience. I was very interested on looking at the Conference programme to find that, of the first fourteen Conferences, all but two were held in towns situated in what have become known as the "black areas" and that, of your last ten Conferences including this one, all but one have been in "white areas." I wondered whether this change in location combined with the proposed change in the name of your Society to which your President has referred, signifies a change in your policy. Whether, in short, you will in the future lay more stress on the benefits of smokeless air than on the evils of air pollution?

If your policy is to give your delegates a practical demonstration of what clean air means, then you have done well to choose Hastings for your meeting place this year. I very much hope that before many years are out you will be able to hold your Conferences in a town that is clean, not because—like Hastings—it has always been clean, but because its atmosphere has been successfully cleared through the operation of our clean air policy. I think this would be a triumphant justification of the work your Society has been doing for so many years and should serve as a great inspiration to all those concerned with air pollution to press ahead with the completion of their task.

As Minister of Power I am vitally interested in the success of the clean air policy, because the main way to clean air is by increased fuel efficiency. I have a dual purpose in that I have to do my best to see that fuels are produced in the right quantities and the right qualities to meet the demands of industry, commerce and the domestic consumer, and at the same time I have to see that they are used as efficiently as possible. It is indeed fair to say that there can be no hope of cleaner air in our cities unless people are prepared in the future to use their fuel more efficiently and more sensibly than they have in the past.

I have said before and I don't mind saying again that I am appalled at the way in which we waste our fuel resources, and in particular at the way in which we waste our most precious asset, coal. I realize that our wasteful habits are a survival from the days when we had cheap and plentiful supplies of fuel in this country. Those days are past, fuel is no longer cheap and our experience since the war has indicated all too clearly that it is no longer plentiful in the sense that we have more than we require for our immediate needs. And yet people continue to waste coal.

To a certain extent I can understand although I do not condone, why many industrialists are still not using fuel as efficiently as they could do. The reason for this is that in many cases fuel costs form so small a part of the cost of production as a whole. But I would have thought in these days of rising costs that industrialists would have been prepared to seize upon any means of reducing costs, no matter how marginal they might be in each particular case, and I would have hoped that they would have had sufficient feeling for the financial interest involved to have made a determined effort to use their fuel more efficiently.

Many of you will have seen the Third Progress Report recently published by the National Industrial Fuel Efficiency Service. It contains an illuminating analysis of the work of heat and power surveys that had been carried out by N.I.F.E.S. qualified engineers, and it is stated that savings of between seven and ten million tons of coal could be achieved every year by industry. Figures like these cannot be easily overlooked, and what is particularly interesting is that a substantial proportion of this saving could be achieved not as a result of massive capital investment but merely by improving boilerhouse operation alone.

Then there is the domestic consumer. You know when you think how bitterly any increase in the price of coal is resented and criticized by the average domestic consumers and yet the majority of them continue to burn their coal at an appallingly low efficiency in old-fashioned open grates. Usually when one buys an expensive item of domestic equipment one justifies the expense by saying that " I will be able to get a lot of use out of it." Surely one would have thought that the domestic consumer would not be satisfied merely to complain about the price of coal, but would do everything he could to use what he regards as a very expensive commodity as efficiently and as well as he could.

I hope that I have not given you the impression of being unduly pessimistic about fuel efficiency but, at the same time, I hope that my remarks will have reminded you that it is not an easy task that you have before you. It is one thing to pass legislation for clean air but it is quite another to implement it successfully. What then, are the keys to successful implementation?

First and foremost I would suggest education of the consumer. When I say education I mean information and not exhortation. You must always remember that you are in a battle against tradition and prejudice, and it will require a great effort to overcome them. What is required is a continuous presentation of the facts to consumers, showing them how they can get better value for their money by using their fuels more sensibly. I am sure that in the long run a practical approach to this problem will secure for you the interest of the consumer. There is already a lot being done in this field by bodies such as the National Industrial Fuel Efficiency Service, the Coal Utilization Council, the Solid Smokeless Fuels Federation and the women's organizations. Their services are available to local authorities to help them overcome the problems connected with smoke control areas, and I sincerely hope that they will take every advantage of the services that are available.

The second thing is for industry and the domestic consumer to use the right type of appliance. Here the Government is giving direct assistance to help consumers to increase their fuel efficiency. For industrialists there is the Government Loan Scheme, which provides capital for approved fuel saving schemes, and loans amounting to £4½ million have already been approved; and investment allowances are available as a measure of tax relief for the installation of certain types of fuel saving equipment. As far as the domestic consumer is concerned, the Clean Air Act provides for grants to be paid where smoky grates have to be replaced. Most of them will no doubt be replaced by coke burning fires. Even the simple types of these fires have a higher efficiency than coal

fires and will therefore help to save fuel but I hope, however, that in choosing new appliances householders will, in their own interests, consider whether it would not be worthwhile to install the newer and still more efficient types of fire which are now available.

The third key, of course, to the successful implementation of the Clean Air policy is the availability of smokeless fuels in the right qualities and the right quantities. The Clean Air Act has come into force at a time when stocks of coke are exceptionally high. This has come about for a variety of reasons including the unusually mild weather last winter, but it does mean that local authorities, in planning their first smoke control areas, can feel assured that sufficient fuel will be available, indeed there appears to be little doubt that there will be ample smokeless fuels for all the smoke control areas that are now coming forward.

The prospects are also good for the period further ahead. Fortunately the flexibility of the fuel industries is such that they should be able to produce substantial additional quantities of smokeless fuels at fairly short notice and without the need to embark on major programmes of additional capital investment. This is particularly true of both the gas industry and the electricity industry whose present plans should make it possible to supply increased quantities of fuel to smoke control areas.

In the long term there is no doubt that new investment will have to be undertaken by the fuel and power industries to meet the requirements of the clean air programme. I am sure that the industries whose responsibility it is to produce the right type of fuel for clean air will be watching very closely the progress that is made and will be ready to adjust their operations and their capital programmes in whatever way may be necessary.

But it is not enough that smokeless fuels should be available. They must also be acceptable. After all, if you are trying to wean people away from their existing habits you have got to make the alternative as attractive as possible. I have therefore stressed to the industries concerned the need for ensuring that the smokeless fuels they supply must be of the highest quality. What is wanted, for example, is a fuel at a reasonable price which can stand up to ordinary use in the tender care of the ordinary householder. I am sure that the fuel industries are giving this problem the attention it deserves.

In conclusion I would like to say that the passing of the Clean Air Act has not meant that either the Government or your Society can sit back and congratulate itself on having done everything necessary to achieve clean air. There are still many problems to be overcome and much work, and in particular much education of the public, to be carried out. It must, of its nature, be a gradual process. It is not a process, in my view, that lends itself to some master plan dictated from above by the Government. Successful implementation, I would suggest, depends upon the gradual adaptation, on the one hand, of the tastes and habits of the fuel-consuming public of this country and, on the other, of the production of the right sort of fuels to meet the new demand as it emerges.

The task of educating public opinion is great, and in this your Society has an important part to play. The present clean air campaign in the North West of England which I was glad to open in Manchester last month, is a good example of the valuable work your Society is doing. There is bound to be resistance to the development of clean air, but I feel that as long as the facts are fully explained to the public and that they are brought to realize how great will be the advantages of clean air, they will respond readily to the lead you are giving. Above all they must be made to realize that clean air can only be achieved by a personal effort, that this is a case where it is not possible to sit back and expect the other chap to do the job. We are most of us respon-

(*concluded, page* 106)

THE REMOVAL OF SULPHUR DIOXIDE FROM FLUE GASES

by

A. Parker, D.Sc., F.R.I.C., M.I.Chem.E.

A Paper with this title was read by Dr. Parker at a meeting in London, on 17*th October*, 1957, *of the Institution of Public Health Engineers. The problem of sulphur dioxide emissions was first discussed and was followed by descriptions of the various processes that have been used at power stations—the Battersea, Howden-I.C.I. and the Fulham-Simon-Carves processes. The recent development of the last named process through research at the Fuel Research Station, and the fact that the large-scale test plant is now operating make this part of the Paper, extracted as follows, of particular interest.*

An investigation was begun in 1939 at the Fulham power station, in co-operation with Simon-Carves Ltd., on the possibilities of removing oxides of sulphur from flue gases by scrubbing with solutions containing ammonia and recovering the sulphur as marketable ammonium sulphate. The experiments included trials with small pilot plant. In the early work, addition of ammonia to the circulating liquor was made by reference to the pH value of the liquor, but control of the process in this way was difficult and the efficiency was not satisfactory. In later experiments, the composition of the washed gas was used as a guide in controlling the addition of ammonia. This work came to an end in 1940 owing to the war. Subsequently an electrical method was developed at Fulham for recording the excess partial pressure of either sulphur dioxide or ammonia in gas which had been in contact with scrubber liquor; this seemed to be suitable as a basis for controlling the addition of ammonia to the liquor.

At about the end of the war, when the possibility of re-starting and extending flue-gas washing was under consideration, the Department of Scientific and Industrial Research, at the request of the Electricity Commissioners, set up a Working Group "to review known processes of removal of sulphur dioxide from flue gases, to consider what improvements could be made in existing processes, and to consider the possibility of research with the object of devising and developing new processes." After studying the processes that had been tried and the many that had been suggested, the Working Group concluded (1) that though the Battersea and the Howden—I.C.I. processes might be improved in detail there was little prospect of effecting a substantial reduction in their cost, and (2) that of the other processes, the most promising was the Fulham-Simon-Carves ammonia process. The Group accordingly recommended that experiments on this ammonia process should be resumed. Arrangements were made for the work to be undertaken at the Fuel Research Station of the D.S.I.R. at Greenwich, with the advice and assistance of the Electricity Authority and Simon-Carves, Ltd.

In the Fulham-Simon-Carves process, from which there is no liquid effluent for disposal, the flue gas is scrubbed with a solution of ammonium salts to which ammonia is added at a rate corresponding with that of the absorption of the oxides of sulphur. If synthetic ammonia or other fairly pure ammonia is used, the circulating liquid is a nearly saturated solution of ammonium sulphate with some am-

monium sulphite and bisulphite; the total concentration of ammonium salts in the liquid is about 40 per cent. (400 grammes per litre). Ammonia and water are added continuously and a portion of the circulating solution is continuously withdrawn. An aeration tank is provided to oxidize the sulphite and bisulphite to sulphate; the oxidation is assisted by the presence of a very small quantity of salts of iron or of manganese as a catalyst. The liquor withdrawn from the system requires little evaporation to separate ammonium sulphate as crystals of a quality suitable as a fertilizer. Synthetic ammonia, however, is more expensive than ammonia in the form of crude concentrated ammonia liquor as produced as a by-product at gas works. This gas liquor contains not only ammonia as such, but also ammonium carbonates, carbamate, and sulphides, and small quantities of phenols and other substances. If crude gas liquor is used as the source of ammonia in the liquid used for scrubbing flue gas, the product solution contains some ammonium thiosulphate in addition to the sulphate and sulphites. It is necessary, therefore, to treat the liquor finally obtained with a small amount of sulphuric acid in an autoclave at about 190°C. to convert the thiosulphate into sulphate and sulphur. Of the solid products eventually produced, rather more than 90 per cent. is ammonium sulphate and 7 or 8 per cent. is sulphur.

The process has been intensively studied at the Fuel Research Station by experiments in the laboratory, including determinations of the equilibrium vapour pressures of sulphur dioxide and ammonia in contact with solutions of the ammonium salts in various concentrations, and by trials with pilot plants supplied with flue gas from the Lancashire boiler at the Research Station. In the pilot plants the flue gas has been treated at rates of flow of about 1,000 and 25,000 cu. ft. per hour; and data were obtained to assist in designing a large pilot plant to treat 1 or 2 million cu. ft. per hour at a power station. It was concluded from this work that the removal of sulphur dioxide down to less than about 0·007 per cent. cannot be achieved by the process with single-stage scrubbing with a solution containing so much as 400 grammes of the ammonium salts per litre. To remove more than 90 per cent. and obtain a solution rich in ammonium salts, it was necessary to scrub the gas in two or more stages. In one series of experiments, the gas was scrubbed in two stages, first with a strong solution and then with a weaker solution; the liquid from the second stage was gradually passed to the first stage and ammonia was added to both stages. Under these conditions, from 95 to 98 per cent. of the sulphur dioxide was removed from flue gas containing only about 0·06 per cent. of sulphur dioxide by volume; the loss of ammonia in the treated gas was from 3 to 8 per cent. of the ammonia added as gas liquor.

Following the experiments at the Fuel Research Station and on the recommendation of the Working Group, the Central Electricity Authority arranged for Simon-Carves, Ltd. to erect a large pilot plant at a power station in the Midlands to treat about 1·5 million cu. ft. of flue gas per day. This pilot plant has been completed and trials have been begun. The trials should provide more precise design and cost data for full-scale plant and should show whether the efficiency of the process is affected by such factors as the chlorine content of the coal burned in the boilers. There is also the question of what happens to the phenols and other compounds in concentrated gas liquor. No odours of phenols or other constituents of gas liquor were noticed in the treated gases from the pilot plants at the Fuel Research Station, but these plants were small and the amount of gas scrubbed was never more than about 25,000 cu. ft. per hour.

From the results of their experiments the Fuel Research Station estimated that the capital cost of a plant to treat the flue gases from a power station burning 1 million tons of coal a year,

(*concluded, page* 106)

NEWS FROM THE LOCAL AUTHORITIES

Battersea

Battersea is proposing to set up at least one smokeless zone.

Bermondsey

Council health officials are making a detailed survey for a smoke control area. The council has put the proposal to the Ministers of Housing and Power, who have replied that they see no reason against it.

Bradford

The Health Committee's plan for one of the biggest smoke control areas in the country has been approved in principle by the Ministry of Housing and Local Government. The area proposed by the committee covers 600 acres bounded by Manchester Road, Smiddles Lane, Southfield Road, Southfield Lane and Great Horton Road.

Chelmsford

The Town Council are considering plans to establish a smoke-free area on their Westlands estate, where there are 1,073 properties, 779 of them owned by the council. The estimated cost of adapting houses to enable smokeless fuel to be used is £6,837.

Croydon

The Corporation have now received the agreement of the Ministry of Housing and Local Government to proceed with the detailed survey that is the first step towards making a smoke control area for the Waddon area.

The Minister of Housing and Local Government has also confirmed the Council's bye-laws concerning smokeless fuel appliances in new dwellings.

Doncaster

Orders declaring that the Hills Lane Estate No. 2 Site and the Grove House Estate be smoke control areas have been submitted to the Minister of Housing and Local Government for confirmation.

Eastbourne

The Council have asked the Minister for confirmation of the bye-law governing the installation of smokeless appliances in new dwellings.

Fulham

It is hoped that the smoke control area to be created by the Council will be confirmed by the end of January.

Hampstead

Only five people objected to the Council's scheme for the Vale of Health to be a pilot area for the beginning of its smoke control area programme. Out of a total of 181 fireplaces in regular use in the area, 69 require conversion for smokeless fuel.

Hendon

A smoke control area is proposed by Hendon Borough Council in the north-western part of the borough. It will apply to the Canons Park area of Edgware and up to the Elstree boundary.

High Wycombe

The Town Council is to apply the Clean Air Act to four council house estates. From September next, tenants will be compelled to burn only smokeless fuel. All future housing estates, council or private, will be declared "smokeless."

Hornsey

Hornsey Borough Council agrees in principle that a residential part of Highgate, covering some 350 acres,

shall be the first smoke control area in the borough. From the top of North Road it extends along Hampstead Lane to Courtenay Avenue, then north to the Great North Road, the northern boundary of the area. On the east it is bounded by North Hill and North Road.

Huddersfield

The Borough should have its first smoke control area in operation on 1st October, 1958. The area includes all properties bounded by Princess Street and John Street in the south, Manchester Street and Market Street on the west, Cloth Hall and King Street on the north, and Queen Street and Queen Street South on the east. It covers 19 acres. The Health Committee have agreed that this first area should be submitted to the Town Council for approval. Subject to this being received, the proposal will be sent to the Minister of Housing and Local Government for approval.

Lambeth

The Council has obtained the preliminary approval of the Minister of Housing and Local Government to its proposal to establish an area of approximately 100 acres, centrally situated within the Borough, as an initial smoke control area. The area is almost entirely residential in character, save for a relatively small number of industrial and commercial premises and four London County Council schools, and is bounded on the north by Prima Road, on the east by Brixton Road, on the south-west by Stockwell Park Road and on the west and north-west by Clapham Road.

Leicester

A smokeless zone order made by the Leicester City Council on 29th October is to be submitted to the Minister of Housing and Local Government for confirmation.

Leyton (Essex)

Representatives of 11 Councils were at a conference called by Leyton Council on 24th October, 1957, to discuss common problems arising from the Clean Air Act. The boroughs represented were Leyton, Walthamstow, Wanstead and Woodford, Hackney, Poplar, East Ham, West Ham, Barking, Dagenham, Ilford and Woolwich.

Liverpool

It has been decided to bring in Liverpool's first smoke control area under the Clean Air Act instead of under Liverpool's own Corporation Act. This will make it possible to take advantage of the compensation clauses of the Clean Air Act, but will involve a delay of about six months.

The City's first Order creating a smoke control area was confirmed on 30th September, 1957, by the Minister of Housing and Local Government. It applies to a 100 acre zone in the business centre of the City and comes into operation on 1st April, 1958. The Order covers an area running from Georges Pierhead to Hatton Garden and Manchester Street.

Manchester

A new smokeless zone in the 43-acre St. George's clearance area, Hulme, was recommended on 15th October, 1957 by the Health Committee. It will be Manchester's 15th smokeless zone, but the first under the Clean Air Act.

Newcastle-upon-Tyne

Total area of zones when complete in 1965 will be 390 acres. The Health Department team making a survey for the first zone have been surprised at the extent of welcome for the zone.

Nottingham

It was announced at a meeting of the health committee, held on 24th September 1957, that the Ministry of Housing and Local Government had approved preliminary plans for a smoke control area in Nottingham.

Poplar

A recommendation to make Poplar a smoke control area was passed at a meeting of the council on 28th October, 1957. An area south of Limehouse Cut, west of the North London Railway and north of the East India Dock Road to the western area of the Borough, is the part of Poplar selected by the council which they will concentrate on as a beginning. The selected area covers the Lansbury redevelopment scheme and consists almost entirely of modern construction which complies with the requirements because the solid fuel appliances are all of an approved pattern.

It is suggested that the second phase could include the Isle of Dogs, and all the area south of East India Dock Road, the third phase, the area south of the Cut; and the fourth, north of the Cut; to the south of Bow Road and to the east and western boundaries of the borough.

Rotherham

The Borough Council has agreed in principle to the establishment of three smokeless zones. These will be in the Kimberworth Park Area, the Herringthorpe area and the Oakwood Sanitorium and Moorgate area, covering a total of nearly 3,000 corporation and private houses and more to be built.

St. Marylebone

In October, 1958, it is intended that the smoke control order for the St. John's Wood area will come into force. St. Marylebone Borough Council, who will assist in the changing of fireplaces in favour of those burning smokeless fuel, have now decided that the Lord's area shall also become a smokeless district in 1959. This district is for the most part residential and many of the homes already have modern appliances and smokeless fuel heating arrangements.

Salford

The Housing Committee has decided to bring into effect as from 1st January, 1958, a regulation that tenants of all its post-war houses and flats must burn smokeless fuel only. The regulation is to be applied to all new tenancies immediately.

The Committee has meanwhile accepted a recommendation from the Medical Officer of Health that the areas including and immediately surrounding four of the six major post-war civic housing estates shall be made smoke control areas.

Sheffield

The area of Sheffield's first smoke control area, approved by the Council in January, is over 400 acres, with a boundary as follows: Sheaf Street, Furnival Street, Eyre Street, Sheldon Street, Cemetery Road, Moore Street, Fitzwilliam Street, Brookhill, Brunswick Street, Leavygreave Road, Crookesmoor Road, Addy Street, Upperthorpe, Montgomery Terrace Road, Infirmary Road, Water Street, Meadow Street, Hoyle Street, Solly Street, West Bar and Castlegate.

Stockport

Final proposals for the first smoke control area are expected to be placed before the Public Health Committee in December. Other areas within the Borough will be considered for their suitability.

The present area consists of between 75 and 80 acres in the middle of the town, and takes in an area from the Town Hall to Mersey Square, Princes Street, Lancashire Bridge, Warren Street, Corporation Street, Millgate, Churchgate, Wellington Street up to Hillgate and along Edward Street back to the Town Hall. There are 950 premises and over 30 factories. Houses represent about one-third of the area and shops and commercial premises about half.

Stoke Newington

Plans for a smoke control area covering 150 acres and containing 2,000 houses, have been submitted to the Minister of Housing and Local Government for approval.

Sunderland

The Health Committee have recommended the adoption of the bye-law governing the installation of smokeless appliances in new buildings.

Walsall

The bye-law governing the installation of smokeless appliances in new dwellings has been approved by the Minister of Housing and Local Government.

Wandsworth

The Borough's first smoke control area is to be in the Putney Vale and West Hill areas.

Westminster

Westminster City Council have been recommended by their Public Health Committee to make a smoke control order for the Temple Bar area. About 425 buildings are affected.

Winsford

The Winsford Urban District Council's Public Health Committee has decided to adopt the bye-law governing the installation of smokeless fuel appliances in new dwellings. The approval of the Minister of Housing and Local Government is being sought.

Woolwich

The Minister of Housing and Local Government has given provisional approval to Woolwich Council proceeding with the declaration of a smoke control area in the St. Mary's district. Approval has also been given to the establishment of smoke control areas in Abbey Wood, Middle Park and Eltham.

Woolwich Borough Council is ready to go ahead with its smoke control plan, at a total cost of £97,000. The Abbey Wood scheme involves an area of 157 acres, with 1,154 houses, and the cost is estimated at £14,846. The Middle Park area comprises 263 acres, with about 1,600 houses, and here the cost is expected to be £82,105. At St. Mary's, an area of 26 acres, most of the houses are new council dwellings, with approved appliances and the cost of adaptations in this area will only be £346.

Lord Mills—*concluded*

sible, in one way or the other, for polluting the atmosphere and, this being so, each of us has a part to play and bad habits to alter. If we succeed in enlisting the co-operation of the public in this way the time will surely come when our towns and cities will lie " All bright and glittering in the smokeless air."

Dr. Parker—*concluded*

and to recover the ammonium sulphate and sulphur as marketable products, would be from £2 million to £3 million according to the type of scrubbers selected and other details. With average British coal containing about 1·6 per cent. of sulphur, the overall cost, including capital charges and allowing for the return from the sale of the products, would probably be in the region of 2s. 6d. per ton of coal burned. This estimate assumes that concentrated gas liquor is the source of the ammonia used in the process.

It should be pointed out, however, that the total amount of concentrated gas liquor that could be produced by the gas industry would only be sufficient for the flue gases from about 6 million tons of coal a year, whereas the power stations in Great Britain already consume about 45 million tons of coal a year. There is also a limit to the amount of ammonium sulphate that could be sold without causing a substantial fall in its market price, with a resultant increase in the cost of the process of washing flue gas. It is thus clear, that even if the ammonia process is fully proved technically, it could only be applied at a few power stations in this country.

Smoke Control Areas Confirmed

West Bromwich Objections Fail

As reported on another page the first confirmation of a smoke control area Order by the Minister of Housing and Local Government, for the central area of the City of Liverpool. As we go to press the Minister has given news of the confirmation of five further Orders, details of which are given below. All will become operative during 1958.

With the exception of the West Bromwich Order, no objections to any of these Orders were received.

In the case of West Bromwich, whose Order covers 25 acres in the Town Centre and affects 250 buildings, objections were received from householders and were later heard at a public inquiry. The principal objections were:

(*a*) that smoke nuisance from industries and the railways should be reduced before householders were required to burn smokeless fuel;

(*b*) that coke fumes in houses suffering from downdraught were dangerous to health;

(*c*) that the cost of replacing or adapting fireplaces to burn smokeless fuels would cause financial hardship to persons on small fixed incomes.

In announcing his decision, the Minister states that as West Bromwich suffers from substantial smoke pollution for which domestic chimneys are as much a contributory cause as industrial chimneys, he must take the view that the Corporation are entitled to use the powers conferred upon them by Parliament to declare smoke control areas. Dark smoke emitted from industry and the railway would be reduced when the remaining provisions of the Clean Air Act came into operation, and he noted that the replacement of steam by diesel trains had already started on the railway line adjacent to the area.

On the question of coke fumes the Minister states that there is no question of these fumes being more harmful than those from coal; they are virtually the same. Even though coke fumes are less easy to detect than smoke, they can be detected, and an examination of the figures of accidents in the home caused by coke fumes in recent years—when the amount of coke used in domestic premises has averaged between 3 and 4 million tons a year—shows that the risks from this cause are insignificant and very much less than those due to falls, burns and scalds, and even to the use of gas or electricity. There is much stronger evidence of harm done to the health of the community by smoke from coal fires.

As for downdraught, the burning of coke will not increase it and might even improve it because of the higher temperature of the combustion gases. The trouble could often be remedied by the use of fires or stoves with restricted throats.

Finally, the Minister points out that the cost of adapting and replacing fireplaces to burn coke ranks for a grant of not less than 70 per cent. and that the Corporation had undertaken to consider sympathetically the payment of more than 70 per cent. in special cases.

In confirming the West Bromwich Order the Minister has postponed the date for its operation until 1st November, 1958, to allow ample time for alterations to fireplaces and to enable the Clean Air Act powers for controlling smoke from industry and the railways to be brought fully into force.

Following are details of the areas

included, with dates on which the Orders become operative, all of which are in 1958.

Bolton C.B. 1st June. Extension of the town centre smokeless zone. 58 acres. 322 premises, of which 252 are dwellings, 40 industries, and 30 commercial and other. Six factories are exempt from the Order.

Denton U.D.C. 1st August. New housing estate of 43 acres, with 142 dwellings.

Hayes and Harlington U.D.C. 1st June. Mainly open space of 240 acres, with 3 dwellings, 1 industry and 22 commercial and other premises.

Ossett B. 1st August. New housing estate of 14 acres, with 186 dwellings and 4 commercial premises.

West Bromwich C.B. 1st November. Town centre. 25 acres, with 249 premises, of which 19 are dwellings 4 industries, and 54 commercial and other.

Scottish Clean Air Council Established

The consitution of the Clean Air Council for Scotland, under the provisions of the Clean Air Act, was announced by the Secretary of State for Scotland on 21st November, 1958. Among the members are Mr. John Innes, Chief Sanitary Inspector, Paisley, a Deputy Chairman of the Executive Council of the National Smoke Abatement Society and President of its Scottish Division. Mr. Thomas Ashford, Senior Smoke Inspector, Glasgow, and a member of the Scottish Division for many years, is also a member. The Chairman is Sir David Anderson, Director of the Royal College of Science and Technology, Glasgow.

The full list of members is:

Bailie W. Drummond, member of the Health Committee of Edinburgh Corporation; Mr. T. M. Ashford, Senior Smoke Inspector for Glasgow Corporation; Dr. I. A. G. McQueen, Medical Officer of Health for Aberdeen; Councillor Mrs. J. Saggar, Convener of the Health Committee of Dundee Corporation; Provost James Paterson, of Falkirk; Mr. John Innes, Chief Sanitary Inspector of Paisley and President of the Scottish Division of the National Smoke Abatement Society; Mr. J. D. Kennedy, County Clerk of Stirlingshire; Mr. R. P. Towndrow, director of Colvilles, Ltd.; Mr. J. W. S. Edmundson, general works manager for Scotland of Fisons Ltd.; Mr. P. M. Thomas, joint managing director of Wm. Beardmore & Co.; Mr. J. Collins, director and general manager of the Mutual Fish Products Co. Ltd., Aberdeen; Mr. C. R. Campbell, Motive Power Superintendent of the Scottish Division of British Railways; Mr. T. S. Ricketts, Chief Engineer of the Scottish Gas Board; Mr. E. Hywel Jones, deputy chief engineer of the South of Scotland Electricity Board; Mr. W. H. Craig, divisional marketing director in the Scottish Division of the N.C.B.; Mr. I. G. Brackenridge, divisional manager of Esso Petroleum Co. in Scotland.

Mr. A. R. Phillip, manager of the Research and Development Department at Carron Co.; Mr. J. Alasdair Anderson, chairman of the Coal Merchants' Association in Scotland; Councillor J. R. Duncan, past-president of the Scottish Trades Union Congress; Mr. H. H. Gattidge, area engineer of the Scottish Fuel Efficiency Committee.

Trash Ban Eases Los Angeles Smog

This is the *New York Times* headline reporting the coming into operation of a new measure to reduce the notorious smog of Los Angeles—a county-wide ban on the 1,500,000 backyard incinerators in which the inhabitants of the region have customarily burned their rubbish. There is now to be a collection by trucks and a fumeless professional incineration of rubbish. It is expected that the ending of this source of pollution will isolate more clearly than before the pollution attributed to the exhausts of the county's 2,750,000 motor vehicles.

Coal Trade Confer on the C.A.A.

Ways in which the coal trade will be affected by the Clean Air Act and the steps which merchants can take to safeguard the market for solid fuel where smoke-control areas are established under the Act were considered at a general conference of members of the Coal Merchants' Federation of Great Britain in London on 28th November.

"OLD KING COAL" AND THE FOG DEMON.

LONDON'S SMOG—IN 1880

It was quite by chance recently that the idle perusal of a bound volume of *Punch*, for 1880 (bought off a barrow for a bob), led to the discovery of the cartoon reproduced above. The original is a double-page, folded in, drawing, and we think it can be left to speak for itself. On an adjoining page were some verses, which also deserve to see the light of day again. We intended at first to reprint only a part of these, but on second thoughts felt that they ought to stand unpruned, giving as they do, behind all their extravagant figures (and more extravagant rhymes!) a grim impression of what winter in London seemed like in those days.

"OLD KING COAL" AND THE FOG DEMON

WELL, yes, Old King Coal *is* a jolly old soul,
And 'twill be a long time 'ere the world wags without him;
But he needs Constitutional check and control,
And so do the minions he's gathered about him.
The rollicking autocrat isn't King Log,
But his rule's not all rosy, a thing to remember,
When finding we meet with the first of the fog
'Ere we part with the last of September.

The Fog Fiend, his comrade, 's a murderous ghoul,
With long patient London is playing Old Gooseberry,
Soot-columns foul, belched from chimney and cowl,
The town in a stench as of long stagnant ooze bury.
Gets London immenser, grow denser and denser
Its fog-veil, less easy and wholesome for breathing,
As though fetid fumes from some demon-swung censer
The town in miasma were wreathing.

Still lengthens, still strengthens, the sway of the pest,
Its malodorous puffings still smoke us and choke us,
Till each of us feels he's a flue for a chest
From Michaelmas right on to March and the crocus.

Five months of asphyxia out of the year,
   With dark as a Tophet, and smells as of sewage,
Are rather *too* much. Who will help London clear
   Of the Fog Demon's annual brewage?

'Tis long 'ere a Londoner's patience will fail;
   But 'tis hard half the year to live silent and placid
In darkness Egyptian, with nought to inhale
   But unconsumed carbon, and sulphurous acid.
How long shall we vainly assistance invoke?
   How long must we bow to this Autocrat's grim knee?
Our City disfigured—its populace choke!
   A prey to the Ghoul of the Chimney?

Let Science and Law take the matter in hand,
   The former has ever for victory thirsted:
And will she sit silent in impotence bland.
   By coal fires and chimney reek utterly worsted?
Death's jackal, disease's sworn ally, the friend
   Of discomfort, and dirt, and destruction Fiend Fog is.
'Tis time to take thought, and the tyranny end
   Of this blackest of Babylon's Bogies!

Reproduced with due acknowledgments to *Punch*.

Chimneyless Houses in Kent

A new housing estate at Meopham, near Gravesend, in which forty houses have neither a fireplace nor chimney pot. The source of heat is a diesel oil burning boiler, thermostatically controlled to heat the house and water. The boilers are situated in a compartment in the garage, which also holds the oil tanks. There are radiators in every room, each of which can be individually adjusted. Maximum cost is £40 a year, using about 20 gallons of fuel a week in the winter and about nine for hot water purposes only in the summer. Estate designed by R. J. Billings and built by Grays Thurrock Properties, Ltd.

CLEAN AIR—WHAT WE KNOW AND WHAT WE DO NOT KNOW

by Sir Hugh Beaver, K.B.E.

SIR Hugh Beaver, Chairman of the late Committee on Air Pollution and a member of the Clean Air Council, delivered one of the Friday Evening Discourses at the Royal Institution on 1st November. He devoted most of his time to considering some of the matters in regard to air pollution that yet needed research and in regard to which the solutions had not yet been found. The Clean Air Act, he said, was essentially aimed at visible pollution, smoke, dust, grit. " I think," he went on, " that the Act contains all the powers necessary to secure the committee's objective which was ' that by the end of ten to fifteen years the total smoke in all heavily populated areas would be reduced by something of the order of 80 per cent.' ' This,' the report added, ' would mean a degree of freedom from air pollution which many parts of the country have not known for more than a century.' The Act goes, I am sure, as far as at this moment of time we can *definitely* go; and it will achieve its limited but quite definite purpose, if it is administered throughout its life in the spirit in which it was passed. This however leaves gaseous pollution virtually untouched."

" One must put first the great problem of sulphur in the air. When the Committee was sitting it was impossible to impeach any one element or factor in the famous London Smog of December, 1952, as the unquestionable cause of the extra 4,000 deaths. It still is. Was it due to a combination of polluting agents? We do not know. Is the combination of sulphur and dust more dangerous than sulphur dioxide in a comparatively pure air? There is no decisive medical evidence yet available on this. We do not know how vital it is to exclude sulphur, or to what extent to reduce the sulphur content, in polluted atmosphere. If it is in itself highly objectionable, but not lethal, then we must calculate our actions to deal with it by our resources. In the U.S.A. vast sums are spent on air pollution because of its nuisance; we cannot afford to spend such sums. We must concentrate on what is imperative. That medical research has yet to decide."

Sir Hugh went on to discuss some of the means of dealing with sulphur either in the raw fuel or in combustion. Turning to other gases he emphasized our ignorance regarding the effect of concentration near ground level of automobile and diesel exhausts. Here again we had no real evidence, either as to the extent of pollution, or the effect on health. Present efforts to deal with motor exhausts in the U.S.A. had so far got no further than producing equipment that would cost £50 per car.

Sir Hugh briefly referred to the absence of work in this country on the effect of air pollution on trees, plants and vegetation. He pointed out that very large areas of potentially fertile land are now rendered wholly or relatively unproductive by atmospheric pollution; and suggested that here was a piece of reclamation needing to be attempted as important as the Dutch reclamation of the Zuyder Zee.

Finally, he emphasized two things, that in the most highly industrialized country in the world we could not look for completely pure air; and secondly, we must measure our objectives by their real urgency and our resources.

THE TRAINING AND QUALIFICATION OF BOILER OPERATORS

Statement by the Society

The following statement, submitted by the Executive Council, was endorsed by the Annual Conference at Hastings. It is being submitted to all local authorities, industrial organisations, the trade unions concerned and others.

1. Much of the success of the new Clean Air Act in preventing industrial smoke will depend on the skill and knowledge of the boiler or furnace operator. It will either be very difficult or impossible for an untrained man to comply with the Act and avoid the emission of dark smoke even from good plant. Also, as has been said before, a careless or unqualified operator may waste in a day as much coal as a miner can produce in a day.

2. The training of stokers and holding of local qualifying examinations was pioneered by the forerunners of the National Smoke Abatement Society nearly fifty years ago, but apart from a very few centres progress in expanding this work has been slow and a great deal remains to be done. Now, however, examinations have been put on a national basis through the introduction of the Boiler Operator's Certificate of the City and Guilds of London Institute. The difficulties associated with the setting up of classes at technical schools and colleges in some areas have been overcome by the development of Home Study Courses with one-day monthly group meetings. This latter method has been used with success by the National Coal Board, the Central Electricity Authority and the National Industrial Fuel Efficiency Service.

3. It is considered that the final objective should be that *all* boiler operators (and particularly those on hand-fired plant) should be qualified by examination. The earning of such a qualification, as in any other case, should carry with it a higher status and rate of pay, or be recognized by the addition of a bonus to the standard rate. It is useless—and clearly unfair—to encourage men to take courses and examinations without such incentive and recognition. There are a number of instances where such recognition is already being given with success.

4. Employers should encourage operators to take the courses by facilitating attendance either at local classes or at the monthly group meetings held in conjunction with Home Study Courses. It is also urged that they should assist, in appropriate circumstances, with fees and travelling expenses.

5. The Society therefore urges, as a first step, that local authorities, industry, the trade unions, and technical schools or colleges should confer together for the purposes of organizing and then publicizing, local arrangements through which all boiler men will be able to take courses and examinations. A small representative committee in each area might be set up to maintain the initial impetus.*

6. In conclusion, we reiterate the importance of the proposals made in this note on the grounds of their value to:

(i) *The Community*, by the reduction of smoke that can be achieved by the employment of trained operatives.

(ii) *Industry*, by the saving of fuel that a trained operator can help to achieve.

(iii) *The Operator*, by giving him a better status and remuneration.

*In some areas existing fuel efficiency, further education or similar committees may already be working on these lines or may be prepared to do so. The purpose of the committees suggested above is to stimulate local interest and recruitment rather than to organize courses, which can usually be done through existing channels.

Competition in Crayford

Other organizers might like to note the interesting competition held in conjunction with a recent clean air exhibition at Crayford, Kent. A large entry was received for the contest, which was to place in order of importance the advantages of using smokeless fuels in the home. The points that had to be put in order included family health, anti-smog, and so on. The winning entry was to be that nearest to a sealed "master" list that had been completed by the National Smoke Abatement Society and deposited with the Town Clerk.

NEWS

Coke Ovens under the Act

In a paper to the Northern Section of the Coke Oven Managers' Association at Durham on 24th October, the Chairman, Mr. R. C. E. Trewhitt, said:

The Clean Air Act's effect on our industry can be regarded as two-edged and on first thoughts the coke oven manager cannot be blamed for regarding it as yet another instrument by which his existence may be harassed.

In the by-product coking industry there have been two compelling reasons why the plant manager should take all reasonable steps to prevent smoke emission from his works. The offending units of plant are well known, but in each case such emission can be regarded either as a sign of inefficient use of fuel or as one of incomplete recovery of products, both of which reflect in the cost sheet. A second reason, however, is also generally held, and that is the desire to improve the conditions in which his employees must work (and incidentally in many cases, in which he also must live).

There can be no doubt that there have been great strides made over the years in the reduction of this nuisance and, if the coking process cannot yet be reckoned as free from smoke and dust emission, this does not point to any dilatoriness on the part of those concerned in it, but rather to the magnitude of the difficulties to be overcome. In spite of the successes achieved in this respect so far, it behoves all concerned to continue their efforts towards further improvement.

In 1856

Dr. Lionel J. Bacon, Deputy Medical Officer of Health, Hampshire C.C., in a Presidential address to the South Branch of the Society of Medical Officers of Health, looked back at the health of London a century ago. He quoted from the records of the *Association Medical Journal*—later the *British Medical Journal*—which showed how different the causes of death were in those days compared with now. In one August week, for instance, of 1,250 deaths, 22 were due to cholera and 253 to diarrhoea. 760 of those who died were under 20 years of age. But, commented the editor of the journal, " these diseases are natural to man, but their ravages are greatly aggravated by the physical impurities of the atmosphere seen from a distance hanging in a cloud over London. The smoke of our manufactories has been rendered less dense than it was by Palmerston's Act. It will ascend as dark as ever in winter from the fires of 340,000 houses."

Opencast

Although not of direct concern to the interests of this journal we would like to draw admiring attention to a booklet *Opencast Coalmining*, published by the National Coal Board. With many photographs and a brief text it explains the how and why of opencast mining in a way that makes it a model for this kind of publication.

Lung Cancer Deaths

In his speech at the opening of the Clean Air Exhibition at Rochdale Town Hall—part of the North West campaign—Dr. J. L. Burn, Medical Officer of Health for Salford and Deputy Chairman of the Society's Council, said it is estimated that some 20,000 people will die from cancer of the lung this year, and that about one-fifth to one-sixth of these deaths will be due to air pollution.

By all accounts Stockport was one of the most successful exhibitions in the series, thanks to excellent publicity. A local newspaper described it as the best exhibition ever held in the town.

From Coal to Coke

Sixth Coal Science Lecture of the British Coal Utilization Research Association, by the Technical Director-General of the Centre d'Etudes et Recherches des Charbonnages de France, M. Raymond Cheradame.

In this Lecture, delivered before a distinguished gathering of scientists and industrialists at the Institution of Civil Engineers on 16th October, M. Cheradame gave an insight into some of the problems affecting the production of coke, particularly metallurgical coke, in France, and described the researches which his organization had undertaken in an effort to solve them.

For many years the French have found it difficult to use certain of their indigenous coals to produce a coke suitable for the blast furnace. In Lorraine, where most of France's iron ore occurs, the collieries have made coke for a long time but it has been suitable only for the domestic market, being too small and friable for use in the blast furnace with the poor quality ore native to the area. Hence, a major task facing CERCHAR—the research organization of the nationalized French coal industry—has been the investigation of means for producing a good metallurgical coke from the highly swelling coals of the Lorraine field.

M. Cheradame recalled that early research into coke making was largely of an empirical kind, and he explained how attempts were made to improve the uniformity of coke by investigating plant in which it was produced rather than the coal from which it derived. More recently, however, it had been realized that fundamental research into the state of coal during pyrolysis could make an important contribution, but that it could come to fruition only if it was associated with tests on a plant scale. He pointed out that, until 1950, the work of CERCHAR had been confined largely to a scientific study of the fissuring and deterioration of coal during heating, little attention being given to the improvement of the large-scale coking process. Since 1950, however, the basic researches carried out at the Verneuil Laboratories of CERCHAR had been supplemented by practical tests on full-scale ovens erected for the purpose at Marienau in the Lorraine coal field. These test ovens were under the direct control of CERCHAR, and by virtue of this arrangement research and practical experience were closely correlated while, at the same time, the effects of industrial factors on coking were given due weight.

In his review of the work carried out in the Verneuil Laboratories and pilot plant, M. Cheradame discussed at some length the investigations made into the fissuring of coal on heating, for the study of which a new technique had been developed by CERCHAR. He also referred to the effects of coal blending on the cokes produced and to the part played in coking by the addition of inert constituents. Problems associated with the large-scale manufacture of coke had been tackled at Marienau, where results had been quickly forthcoming. These had not only provided guidance to industrial coke manufacturers but had also often pointed the way to improved methods in the research laboratories.

In M. Cheradame's view, three main ideas would dominate future research on coking. These were, first, that the chemical use of hard coal in the form of metallurgical coke was advantageous and should be developed, second, that anthracite and, more generally, smokeless fuels should be used for solid fuel domestic heating and, third, that the range of coals which could be coked corresponded, in many countries, to too small a proportion of coal output, and should be extended.

The Quest for a Catalyst

We reprint, with acknowledgments, an article from the August-September, 1957, number of the *Report* of the Air Pollution Control District of Los Angeles.

MEDIEVAL alchemists dreamed of a legendary substance which would transmute base metals into gold—the Philosophers' Stone. Centuries of tinkering failed to produce such a magic elixir, but they did lay the foundation for the modern science of chemistry.

The present search for a catalyst for the auto exhaust has points of similarity. The substance sought must transmute auto exhaust into harmless vapour, and the prospect of riches is tantalizing: the assured market of three million automobiles in Los Angeles County, and the eventual likelihood of sales in every other smog-plagued area in the world.

Ever since the "hydrocarbon theory" of smog formation was enunciated in 1951, attention has focused on automobile exhaust as the primary source of the ingredients of smog. The theory, which has been confirmed by many experimenters and observers, holds that hydrocarbons—the type of chemical compounds that make up gasoline—react with oxides of nitrogen when stimulated by sunlight, and this reaction forms smog.

The automobile engine not only emits a stream of burned, partially burned, and raw hydrocarbons, but it also creates great volumes of oxides of nitrogen. Oxygen and nitrogen, the main constituents of air, remain chemically separate at normal atmospheric temperatures. At high temperatures, however, they unite in varying proportions and form a number of compounds, which are grouped under the name, oxides of nitrogen.

When the automobile engine sucks in air to burn with the gasoline, it exposes oxygen and nitrogen to the heat of the combustion chamber. Oxides of nitrogen are formed and are blown out of the tailpipe, thoroughly mixed with hydrocarbons. Much as dynamite remains inert until the proper detonation sets off an explosion, the exhaust mixture hangs near a critical balance until it is triggered by sunlight. Then like a brushfire, the reaction spreads through the mass and forms smog.

The problem of eliminating this contribution from our three million rolling smog-factories has been divided thus: either do something to the mixture before it enters the combustion chamber—the "induction phase," or to the exhaust after it has burned—the "exhaust phase." The possibility that something may be done during the burning process itself also is being considered.

For many reasons, it has seemed desirable to attack the problem in the intake or induction phase. Studies have shown that a large percentage of the unburned hydrocarbons are emitted during the period that the car is decelerating—showing down with the foot off the gas and the engine acting as a brake. Even though only a small amount of gasoline is drawn into the engine at such times, almost all of it goes out without being burned because it is so diluted with exhaust gas. Much attention has been given to devices which will cut off this trickle of gasoline completely during deceleration, but at best, this is only a partial solution.

A far more satisfactory answer can be found if the exhaust itself can be treated so as to eliminate unburned hydrocarbons during all driving periods. Most of the suggestions that flood to mind such as filters, scrubbers, or collectors, prove to be impractical on more careful analysis. However,

the possibility of burning the hydrocarbons has considerable scientific merit.

One method of disposing of similar fumes in many fixed installations is by an afterburner. If more oxygen is added to the unburned hydrocarbons in a collection chamber, under some conditions, they can be re-ignited by a flame or a spark. Several auto exhaust afterburners have been designed on this principle.

The effective use of these afterburner mufflers has been limited to large vehicles, chiefly buses, by several factors, among them the large size of the units, and the high temperatures from which the car and its occupants must be protected. The rich mixture of fuel and air required limits the effective period of operation largely to deceleration. As a further complication, the addition of fresh air to the afterburning process increases the oxides of nitrogen.

Many of these objections can be overcome by recourse to another principle of combustion, catalysis, in the form of a catalytic converter or muffler. In theory, such a muffler can be smaller, will burn during most of the driving cycle, and operates at considerably lower temperature than does the flame type afterburner. The problem of insulation is eased, and a smaller amount of oxides of nitrogen may be produced.

Catalytic mufflers have proved successful in many applications. A properly designed catalytic muffler can reduce engine exhaust, including the lethal carbon monoxide, almost entirely to carbon dioxide and water vapor, both considered harmless as air pollutants. The mufflers are used indoors on warehouse forklifts, tow trucks, mining equipment, and on stationary engines. They are effective on diesel and propane fueled trucks, buses, and boats. Unfortunately there is one distressing limitation to the catalytic muffler: it ceases to operate in the presence of lead. And modern gasoline contains, and evidently will continue to contain, a substantial amount of tetraethyl lead in every gallon.

To understand why this limitation exists calls for a more detailed glance at this intriguing aspect of modern chemistry, catalysis. A catalyst is any substance that alters the velocity of a chemical reaction without appearing in the end products. More than half a billion pounds of catalysts are used by American industry ever year in an astounding range of applications. One of the oldest is the hydrogenation of fats, which transforms liquid oils to solids, such as margarine and cooking shortening. Gasoline, plastics, synthetic rubber and fibres, foods and medicines are among other basic products benefiting from catalysis. Despite this widespread use, and the fact that scientists have been investigating the process for about two hundred years, we still know less about what occurs on the surface of a catalyst than we do about what is going on in the nucleus of the atom.

Because of the lack of certainty of the nature of the process itself, there is disagreement as to what actually happens when a catalyst is "poisoned." What is known is that many substances interfere with the action of a catalyst by minimizing or destroying its activity. This effect can be caused in some cases by scarcely detectable amounts of lead.

The lead compound known as tetraethyl lead has been used in gasoline since 1923. Its function is to improve the anti-knock quality of the fuel, and its use has permitted an increase in compression ratios and higher standards of automobile performance. The lead serves to slow down the explosion of the mixture in the cylinder so that burning takes place in a smooth surge of power rather than as a jarring and destructive detonation or "knock." The increase in efficiency is so substantial that it would be difficult to "detune" a current model engine to the point where it would perform acceptably on the same gasoline it now uses were the lead to be removed.

Adding lead increases the cost of manufacturing gasoline, and if the refiners were able to produce acceptable fuel without this expense the forces of economics would impel them to do so. There is some "white" gas, that does not contain lead, still produced for less demanding engines, and in a few areas a combination of unusual economic factors at certain refineries permits the marketing of a limited supply of high quality unleaded fuel; but, except for such infrequent cases, an anti-knock additive is deemed necessary. Although many substitutes have been tried, practically all gasoline produced for automobiles today contains tetraethyl lead. In fact, the demand has continued to increase until this is now the largest single application of lead, other than its use in storage batteries.

It was to bring into focus the need for a catalyst that will operate in an automobile exhaust system that representatives of more than fifty leading companies in the field of catalysis gathered in Pasadena last March. The meeting, officially titled "The Conference on Catalytic Decomposition of Vehicle Combustion Products," was arranged by the Air Pollution Control District and the Air Pollution Foundation to provide for an exchange of views and to stimulate the interest of American industry in producing an effective auto exhaust control.

One of the most provocative suggestions advanced at this meeting was that an exploration be made of the possibility of finding a catalyst that itself contained lead. Such a catalyst not only could be immune to "lead poisoning" but might even be improved as lead accumulated on it during driving. While the most widely known catalysts are so-called "noble metals," especially platinum and palladium, a multitude of other metals are used as commercial catalysts, among them molybdenum, vanadium, iron, copper, chromium, nickel, antimony, barium, and aluminium. Interestingly, some of these substances, which are themselves catalysts, are poisons to others—iron, for one. From these facts, it is not unreasonable to conjecture that a lead-based catalyst may be attainable.

Another facet of the entire attack upon the auto exhaust, is the feasibility of treating the other smog-making component, the oxides of nitrogen. Experiments have been made to determine whether it might be possible to decompose the oxides of nitrogen by catalysis. The results as to catalysis were not encouraging but in the course of the experiments it was determined that charcoal, which had been activated with potassium carbonate, caused an appreciable decomposition of oxides of nitrogen. The activated charcoal reduced the oxides of nitrogen approximately 85 per cent., yielding inert nitrogen gas and carbon dioxide. Oddly, the addition of lead oxide seemed to improve the reaction!

This experiment has aroused a number of speculations. If the oxides of nitrogen can be reduced by this process, which is estimated to cost less than one cent per gallon of gasoline, will the hydrocarbon reaction that forms smog slow down sufficiently to relieve our overall air pollution problem? Is this attack upon oxides of nitrogen an answer in itself?

Another point raised: is it possible to combine the reduction of oxides of nitrogen by this carbon reaction, with the combustion of hydrocarbons and oxygen? Can they be made to operate within the same container, or if not, then in successive units?

This is the type of speculation that in the course of scientific inquiry evokes answers. Based upon the accomplishments of our technology where knowledge was at a similar level, and considering the economic stimulus, it does not seem arbitrary to assert that a control for the automobile eventually will be found. Certainly, whether the ultimate device is based upon catalysis, or combustion, or upon some other, yet unconsidered process, The Quest for a Catalyst is turning up some exciting new possibilities in air pollution control.—RMB.

HOW MUCH SULPHUR DIOXIDE?

Different Fuels Compared

Comparisons of sulphur dioxide emissions by the different fuels are frequently quite misleading. The percentage of sulphur in a fuel, by itself, may mean little, and yet it is this figure that is most frequently cited.

A technical correspondent has sent us some calculations that give a much more satisfactory basis for comparison, in that they show how much SO_2 is emitted in the production of one useful therm. It is obvious that the actual emission depends on the amount of sulphur in the fuel and the amount of fuel that is used. This in turn depends on its calorific value and the efficiency with which it is burned.

The calculation for each fuel is given but as each is made in the same way it will suffice to give one case only —for coal—as an example.

Coal is taken as having a calorific value of 11,000 B.Th.U.s per lb., to have a 1.5 per cent. sulphur content, and a combustion efficiency (in an industrial boiler furnace) of 60 per cent.

To obtain one useful therm, or 100,000 B.Th.U.s:

$100{,}000 \times \frac{100}{60} = 166{,}000$ B.Th.U.s are needed.

These are given by $\frac{166{,}000}{11{,}000} = 15$ lbs. of coal.

Since 1 lb. of sulphur gives 2 lbs. of SO_2 the amount of SO_2 from 15 lbs. of coal is

$15 \times \frac{1.5}{100} \times 2 = 0{\cdot}45$ lbs.

Making a similar calculation for each of the other fuels examined, the adjoining table may be constructed.

These figures may be open to some criticism, but in substance we think they provide a fair comparison. The figures for coal and coke are of course substantially reduced if a higher boiler efficiency is attained, as it can and should be. This is one more reason for increased fuel efficiency. The high sulphur content in heavy fuel oil, the 950 seconds oil, is counterbalanced, as far as comparison with coal and coke are concerned, by its high calorific value and combustion efficiency.

Our correspondent includes electricity in his list, with an overall boiler and transmission efficiency of 25 per cent. This gives a high SO_2 emission per useful therm, but the comparison is not quite in line with the others as the level of discharge from a power station stack is on the average much higher than from ordinary boiler plant, giving much greater dilution at and near ground level.

The highest emission of sulphur dioxide, for this table, is for coke. This may be the case for industrial boilers, but it must not be taken as applying—in comparison with coal—to domestic open fire use, where the higher efficiency of coke will equalize the relative emissions. Both town's gas and kerosene, if used in flueless heaters, give higher efficiencies and therefore even less SO_2 emission than the figures shown in the tables.

Fuel	*Calorific Value (B.Th.U.s/lb.)*	*Boiler Efficiency*	*Sulphur Content*	*SO_2 emission (lb.) per useful therm*
Coal	11,000	60	1·5	0·45
Coke	11,000	60	2·0	0·60
Town's Gas	450/cu. ft.	70	20 gr./ 100 cu. ft.	0·018
Kerosene (ordinary grade)	20,000	70	0·065	0·009
Kerosene (premium grade) ..	20,200	70	0·035	0·005
Gas Oil	19,600	70	1·0	0·148
950 secs. oil	18,500	70	3·5	0·546

REPORT ON A CLEAN AIR CAMPAIGN

The first co-operative campaign of its kind, in the West Midlands, took the form of a series of exhibitions in different towns during last winter. Initiated by the Midland Centre of the Association of Public Health Inspectors, it was supported by the N.S.A.S., the Solid Smokeless Fuels Federation, the West Midlands Gas Board, the Midlands Electricity Board, the C.U.C., Combustion Engineering Association, D.S.I.R., N.I.F.E.S., the women's organizations for electricity, gas and solid fuel, and the National Union of Townswomen's Guilds.

Twelve exhibitions were held, between September, 1956 and March, 1957, in the following towns: Dudley, Darlaston, Stoke - on - Trent, West Bromwich, Halesowen, Oldbury, Wednesbury, Wolverhampton, Coventry, Nuneaton, Rowley Regis, and Walsall.

The organizing committee has now issued a most useful report on the campaign, which includes the replies to a questionnaire that was sent to all the local authorities which held an exhibition. The information given by the replies is most illuminating.

The figures for attendances are particularly interesting. The best attendance at any one exhibition was around 6,000 which included 1,500 school children in organized parties. The worst attendance is given as 170, including 120 school children. In the first town £225 was spent by the local authority—apart from the cost of the hall—and presumably largely on publicity. In the second case the expenditure was £2 10s. 0d.

In four exhibitions the interest of schoolchildren was stimulated by either essay or poster competitions. During most of the exhibitions lectures, a brains trust or a quiz programme were organized, generally by the women's organizations. The largest attendances at any of these meetings is given as 100, but in some cases very small attendances indeed are recorded. The questionnaire also gives information on the nature and type of publicity used.

The organizing committee makes some observations on this questionnaire and on the campaign generally, as follows:

(*a*) It can be claimed that the campaign has created considerable interest with the general public in the subject of clean air.

(*b*) The degree of interest shown by the public in districts where an exhibition was held was undoubtedly in proportion to the efforts made to publicize the exhibition. There was ample evidence to show that effort wisely combined with expense in publicizing the exhibition, brought its rewards. It may usefully be added that, if from financial or any other consideration an exhibition is not likely to be a success it is better not to attempt the staging of one.

(*c*) The attendance of school children in supervised groups, and the arrangement of poster and essay competitions for children created a nucleus of interest which did much to ensure the success of the exhibition in districts where these arrangements were made.

(*d*) The distribution of invitation folder cards to the general public showed that a planned, intensive distribution a few days before the opening of the exhibition was preferable to uncontrolled distribution over a long period.

The report also adds that the campaign " in addition to furthering the cause of Clean Air, did also demonstrate that it was possible for so many organizations to work in harmony to achieve a purpose which, it

must be said, few really believed at the commencement could be achieved."

The most important points in these observations are (*b*) and (*c*), and they bear out impressions gained from observations of other exhibitions and similar attempts to create public interest in clean air. Further conclusions might be drawn from the replies to the questionnaire. Thus it is evident that meetings held in conjunction with clean air exhibitions are more likely to be successful if they are not simply " public " but are organized by or for local organizations. Competitions for schoolchildren are valuable, but there is no reason why they should not be extended by competitions open to the public generally. It is a pity, but it has to be admitted that the drawing power of clean air in itself is not usually sufficient to ensure success unless some kind of novelty or " gimmick " can be introduced.

From the attendance figures it appears that the total attendance was about 20,000 adults and rather less than 10,000 children. The total cost to the local authorities appears to have been less than £1,500, but to the exhibiting organizations the combined cost of stands, equipment, transport and staff must have been many times this amount. The cost per visitor must therefore have been quite a few shillings, perhaps not far short of a pound. If this was the only criterion for measuring the success of the campaign it would be pretty expensive but it has to be remembered that the propaganda value of such a campaign may extend well beyond those who actually came to the exhibitions. Publicity in the press, even the useful A.A. direction indicators in the streets, all help to create awareness of the fact that " clean air " means something. These factors are difficult to evaluate, but one thing is certain: such a campaign to be of lasting value must be followed up by continuing propaganda. Reiteration is the better part of salesmanship. It is therefore gratifying that the organizing committee states that " The campaign will go on."

(*Copies of the report may be obtained from the Hon. Secretary of the Campaign Committee, Mr. H. E. T. Lowbridge, Chief Public Health Inspector, Health Department, Walsall St., Willenhall, Staffs.*).

Tributes

The subjects presented for edification of and discussion by the delegates at last week's annual conference convened by the National Smoke Abatement Society, again showed evidence of careful selection, judged by their usefulness in giving momentum to action stemming from the Clean Air Act of 1956 . . . we wish the N.S.A.S. under its new title of National Society for Clean Air a period of greater usefulness and success than ever.—*Medical Officer*.

While we do not believe that a mere change of title can achieve anything very much, the implications are that the N.S.C.A. will continue to go forward with just as much resolution as we have come to expect from the N.S.A.S.—*Iron and Coal Trades Review*.

Acceptance Tests for Boilers

British Standards Institution has published (B.S.2885) a standard on *Acceptance Tests for Steam-Generating Units* (12s. 6d.). This lays down the procedure for the determination of thermal efficiency, by direct measurement of the heat input and the heat output together with the determination of the losses in the products of combustion and in the refuse. As an alternative, directions are given for evaluating the efficiency by the heat-loss method. Tests on the performance of auxiliary plant and on steam purity are also included, and a standard form of test report is given in detail with explanatory notes. The code is concerned with stationary steam-generating units of the power-station type, fired by solid fuel, oil or gas.

N.I.F.E.S. PROGRESS

Searchlight on Fuel Inefficiency

Third Progress Survey, with Report and Accounts, for the year to 31st March, 1957. National Fuel Efficiency Service, London.

The N.I.F.E.S. report is impressive, both by reason of its excellence of production and the facts that it reveals about the deplorable amount of fuel wastage that the activities of the organization are bringing to light.

A series of coloured charts, for instance, includes the following facts:

For Lancashire boilers with economizers a reasonable efficiency target is 75 per cent. net. 94 *per cent. of* 402 *boilers examined fell below this mark.*

A standard of 9 per cent. CO_2 in the flue gases should be readily obtainable. 90 *per cent. of the boilers tested fell below standard, and in* 45 *per cent. the* CO_2 *did not exceed* 6 *per cent.*

With hand firing the skilled man achieves excellent results. But the average results are poor. *Only a quarter of the hand fired boilers exceeded* 65 *per cent. efficiency and over a quarter fell below* 55 *per cent.*

By contrast it is pointed out that the average combustion efficiency in power stations has increased from 69·5 per cent. in 1920, to 89·7 per cent. in 1955.

The report gives details of how the activities of the Service have continued to expand, the most rapid development being in Regular Service Agreements, whereby plant operation is kept at high standard. The number of such agreements increased over the year from 262 to 426. A new "Specific Advisory Service," introduced during the year, to deal with particular problems as they arise, rapidly found favour and was used by 464 firms.

Reference is made to the Clean Air Act as follows:

"Another development arises from the provision in Sections 3 and 6 of the Clean Air Act for prior approval by local authorities for specifications for new furnaces and grit-arresting plant. The Ministry of Housing and Local Government and the Department of Health for Scotland have suggested to local authorities that they may wish to take advantage of the experience of N.I.F.E.S. engineers when considering such applications. A number have already invited N.I.F.E.S. area engineers to act as their advisers or to sit with other experts on 'prior approval panels' which they are forming."

Many interesting case histories are outlined, and from among them we will quote one that shows how even the smaller firms, such as laundries, can benefit from the help available from N.I.F.E.S.

"The saving which may be made even by relatively small consumers of fuel is well illustrated by the case of the Electric Sanitary Laundry, Barnsley, where the management requested that a comprehensive survey should be made of boiler plant efficiency and of steam usage. The firm was burning 520 tons of coal per annum in a hand-fired economic boiler, which was found to be operating at a very low efficiency. Merely by improving the boiler performance and fitting a mechanical stoker, a fuel saving of 38 per cent. can be obtained. This saving can be increased to 48 per cent. by installing a flash steam recovery system, covering the boiler feed tank, and providing a calorimeter to supply hot water to the washing machines."

Training and Education

One section of the report is devoted to the training of boiler operators, a field in which the N.S.A.S. is particularly interested, and grateful to N.I.F.E.S. for the work they are doing. Their engineers have spent a considerable amount of time in the training of individual operators, but

this was an expensive form of instruction and it became apparent that a new approach was required. N.I.F.E.S. therefore decided in the winter of 1955 to introduce a training scheme whereby men could study at home and receive practical instruction in groups at their own workplace, or at a nearby plant.

The results in the first eighteen months have been encouraging, as more than 1,800 men were enrolled, of whom 95 per cent. completed the six months' course. In the first two examinations for which N.I.F.E.S. men were eligible, 82 per cent. were successful.

Despite this, and the rise in the number of candidates for the City and Guilds examinations, the report points out that there are many thousands of boiler operators who are still untrained and are wasting a considerable amount of fuel as a result. "Leaving aside the separate training schemes of the C.E.A., the N.C.B., and the Ministry of Health, which recently announced its own training scheme for boiler operators in hospitals, the task is a formidable one. Even if the rate of intake into N.I.F.E.S. course was stepped up from the present figure of about 1,200 a year to 5,000, it would still take many years to train all the men in industry."

Some instances of the results of training boiler operators are cited. At a rubber company where seven boiler operators were trained, fuel consumption was cut by 50 tons a week, and at a smaller factory 28 per cent. of an annual consumption of 480 tons was saved. One firm finds that as a result of instruction given to the stoker at their Hertford brewery, it is now possible to maintain an average of 11 per cent. CO_2, whereas previously the figure was 8 per cent. In another brewery, at Ipswich, a single stoker saved $2\frac{1}{2}$ tons of coal a week.

GAS DEVELOPMENTS

Natural gas at Cousland, near Edinburgh, is now being pumped to the Musselburgh works of the Scottish Gas Board. It is calculated that one ton of coal will be saved for every 7,000 cubic feet of natural gas used. A well has been driven 1,600 feet through non-porous rock to a bed of porous sandstone where the gas has been formed. It is 94 per cent. methane or associated gases, with 6 per cent. of nitrogen. It contains no sulphur. The calorific value is between 930 and 960 B.Th.U's, compared with the 450 B.Th.U's of the gas manufactured at Musselburgh.

In the West Midlands methane is being taken by the Gas Board from North Staffordshire collieries, and is being mixed with manufactured gas at their works. The scheme is the result of collaboration between the West Midlands Divisional Coal Board and the West Midlands Gas Board. It is expected to save 1,000 tons of coal a week by the middle of next year.

From France comes a report of the storage of gas for winter and other peak load periods, in a natural "gas holder" under the forest of Beynes. The gas is being pumped into a mass of porous sand that is covered by a dome-shaped stratum of impermeable clay. Beneath is another impermeable stratum. The watery sandy layer is about three miles long by one and a half miles wide. It can contain about 320 million cubic metres of gas, although only 150 million will be available for annual consumption 700 large metallic gasholders would have had to be built to store this amount of gas, at 200 times the cost of the underground storage. Gaz de France is now prospecting for other possible sites.

If this method could be developed in this country it would assist the provision of a heavier gas load in the winter months, which would be of great value to the programme for smoke control areas.

FUEL IN THE HOME

Some extracts from an address to the Coal Utilization Council Silver Jubilee Convention at Guildhall, London, on 21st October, 1957, by Dora M. Charlton, B.Sc. Mrs. Charlton is Chairman of the Women's Advisory Council on Solid Fuel, and is their representative on the Society's Executive Council.

SUPPOSING I am a housewife living in a pre-war local authority house. I have to accept what I find in the way of fuel equipment, and when, bearing in mind the appeals to use smokeless fuel efficiently, I ask the Local Authority to do something about the ineffective means provided—what is the answer?

Unless the particular area in which I live is to be a smoke control area or smokeless zone, the chances are that the answer will be that the Local Authority cannot afford to do anything about it, and here let me add that knowing the difficulties and restrictions under which the Local Authority works this is understandable, but neither can *I* afford to convert the old equipment to new, therefore the status quo remains and I continue like thousands of other housewives, to put up with poor comfort, much dirt and much unnecessary work. This position, of course, would also apply in many pre-war blocks of flats. Whether the position will change under the new Housing Act remains to be seen, but I am afraid there will still be no *material* improvement in the position because so long as the result of the capital investment by one body leaves the dividends, in the shape of saving money, time or labour accruing to a different body, the position is difficult, if not impossible.

If, however, I live in a house owned by a private landlord—not in a smoke control area—and I try to persuade the landlord to take advantage of the 1954 Housing Act and improve the heating and the cooking arrangements of his house, I find that he may be able to increase the rent without expending money on *this particular* form of alteration. I, on my part, am not going to invest any capital on improving *his* property even to gain extra comfort and convenience and so again no action is taken.

On the other hand, if I already live in my *own* house and change over to the latest types of solid fuel burning equipment, thereby giving myself more ease and comfort and at the same time performing a patriotic act by putting myself in the position to use the type of fuel in greatest supply and incidentally also making some contribution to cleaner air—*if* I then try to offset this cost by claiming for house repairs on my income tax form I find that such changes are considered, quite rightly I suppose, as improvements and thereby not an expense allowance for tax purposes, but had I waited for my locality to become a scheduled area I may have been able to claim seven-tenths of the cost of the conversion. In this event being a forward woman does not pay off, and individual effort is stifled by the dead hand of the Treasury.

* * *

The next step then in an intelligent plan for solid fuel sales and, bearing in mind the formation of smoke control areas, would be to encourage the consumer to burn coke, whether gas coke or hard coke. The low temperature cokes and the new reactive gas cokes make their own appeal to the few who can afford them but there is still a reluctance on the part of the domestic consumer to use coke in an open fire—even in a modern efficient grate. This reluctance may be more prevalent in those parts of the country where there is a longstanding tradition of a big bright coal fire—but it is in these parts that the new smoke control areas will be set up.

We, as a Council, have tried in the past to explain to the housewife that

the poisonous fumes which make grannie cough and the children feel sick are due either to an over-developed imagination or faulty installation—or perhaps just a dirty chimney.

But such explanation seems to fall on stony ground and the only way to make the ground more fertile and receptive to these suggestions is, I contend, to reduce the price of coke. We all know why coke is expensive to buy but none of the reasons are convincing to the layman. After all, it is of no use to tell the coke consumer who does not also consume gas that so to speak, what he pays on the swings comes off on the roundabouts. If it *were* possible to make the price of coke lower than that of coal the incentive to try to like coke would be strong and the advantages, in economy in use, safe, if burnt in a suitable stove or grate, and light, easy and clean to handle, would soon make their appeal to the consumer. This problem of the unpopularity of coke for domestic purposes will hamper the implementation of the Clean Air Act very effectively if not tackled at national level by some authority *with executive powers.*

However big an axe we may have to grind, we should like clean air for our own if not for our neighbours' benefit, and as fuel efficiency and clean air are inseparable we are *all* pledged to fuel efficiency.

The Reports of the Egerton, Simon, Ridley and Beaver Committees have by slow stages at last resulted in a Clean Air Act. We have been given fifteen years to clean up the black areas and if this can be achieved, we shall then have also made some contribution towards bridging the fuel gap which the experts predict, between estimated fuel supply and anticipated demand during the next twenty years and although the old adage of the economists that private gain is a public advantage is not always true, it *is* in the case of the efficient use of domestic fuel.

Although there is still much to be done in the education of the general public on Domestic Fuel Efficiency, even with a small band of workers much has been achieved during the last twenty years. As I do not want this to sound like an empty boast I should like to give you some real proof.

The General Index of Production has risen by 58 per cent. since 1938 according to the London and Cambridge Bulletin. Coal output is about the same as it was in 1938—220/230 million tons a year. The domestic consumption of coal also remains about the same, some 33 million tons (but now, of course, buttressed by greater consumption of gas and electricity). We still spend in 1957 about the same proportion, i.e., 4 per cent. of our national income on fuel and lighting as we did in 1938. On the face of it this would rather give the lie to an increase in Domestic Fuel Efficiency but when we remember that although between the census years of 1931 and 1951 the population rose by only 8 per cent., the number of houses rose by 30 per cent., each fire or stove is therefore warming, washing and feeding fewer people so, to have maintained the expenditure at the same proportion clearly indicates a not inconsiderable gain in efficiency.

Some education of the public has therefore borne results but not results that lead to any complacency on the part of the educators.

Concessionary Coal

The West Riding Clean Air Advisory Council state that some useful contacts have been made as a result of their appeal in the Summer issue of *Smokeless Air*, and ask us to repeat this. The notice was to the effect that the Council wished to make contact with similar bodies in other areas to exchange views and take joint action, when appropriate, on matters concerning the Clean Air Act, with particular reference to the problem of concessionary coals. The Hon. Secretary is Dr. I. G. Davies, Public Health Department, 25 East Parade, Leeds, 1.

Air Pollution in the Iron and Steel Industry

An important conference on this subject was held in London on 25th and 26th September. It was organized by the Iron and Steel Engineers Group of the Iron and Steel Institute, and was attended by some 500 persons, including representatives from Austria, Belgium, France, Norway, Sweden, U.S.A. and U.S.S.R. Fifteen papers were presented and discussed and are to be published by the Institute as a Special Report. Short abstracts of the papers are given below.

External Pollution from an Iron and Steel Works and Measures towards its Reduction, by S. H. Brooks and W. J. Calvert (Appleby-Frodingham Steel Company).

Iron-ore preparation and sintering, and the use of liquid fuels in O.H. furnaces, have created new problems of dust and fume emission from iron- and steel-works. The measures taken at Appleby-Frodingham to minimize air pollution are detailed and figures of emissions are given. Methods of making further reductions are also considered. An attempt is made to assess the cost of pollution damage caused by the industry in general, and by Appleby-Frodingham in particular, to illustrate that the economics of installing further plant to reduce pollution must be carefully studied.

The Capital Costs of Some Waste-gas Cleaning Plants for use in Iron- and Steel-works, by R. A. Granville (British Iron and Steel Research Association).

The capital costs of some commercial cleaning plants capable of treating the waste gases from several processes operated in iron- and steel-works are presented in tabular and graphical form. The data were obtained by direct enquiry to plant manufacturers, and mostly relate to electro-precipitators.

External Dust Deposition and Sulphur Emission, by H. G. Jones and J. T. Davies (Steel Company of Wales, Ltd.)

Methods of surveying dust and sulphur gas emissions in the locality of the works are described. The worst areas are within the works. It is suggested that these methods of assessment are essential to determine both the magnitude of the problem and the effects of ameliorative action.

Mitigation of Air Pollution in Sinter Plants, by A. H. Meadley, J. G. Colvin and H. J. Gamble (Stewarts and Lloyds, Ltd.).

The Iron and Steel Industry, with its variety of processes and equipment, presents a diversity of problems in air pollution. The sinter plant, where hot, dusty materials and gases are being handled continuously, is probably one of the most difficult sections of the industry in which to control dust. At the Corby works of Stewarts and Lloyds, Ltd., investigations have been carried out over the past eight years to find the degree of dust dispersal from the various sources, and, as a result of these investigations, to determine the most suitable equipment to deal with this problem. The results at times have been discouraging but it is now considered that the future will show very marked improvements in the control of dust at the sinter plants.

Operation of Electrostatic Precipitators on O.H. Furnaces at Fairless Works, by E. B. Speer (United States Steel Corporation).

The paper contains information on

the electrostatic precipitators on 330-ton basic O.H. furnaces at the Fairless Works of United States Steel Corporation. The furnace system is discussed to indicate the scope of the dust-cleaning problem with respect to volumes, pressures, and temperatures. Modern instrumentation enables the operator to accomplish the steel-making process with good combustion efficiency and minimum furnace damage. The precipitator construction is described by presenting the design features of the chamber, collecting electrode system, discharge electrode insulators, electrical supply units, and safety devices. Dust collection from the precipitator hoppers is performed by a vacuum system with hoppers, piping, primary and secondary collectors, scrubber, exhauster, storage bin and pug mill. Problems and solutions after four years of operation are discussed for possible assistance to other operators. Design conditions of inlet loading, draught losses, outlet loading and efficiency are stated. The testing procedure used to check precipitator performance and the test results obtained are explained. The most serious problems encountered at Fairless have resulted from gas velocity increase and boil-period concentrated loading. Recent and anticipated improvements of major importance to decrease outlet loading by 100 per cent. are described as a result of data obtained to date.

A Pilot Plant for the Removal of Iron Oxide Dust from the Fumes arising in the Pre-refining of Iron with Oxygen, by Louis G. Septier (I.R.S.I.D.).

The injection of oxygen into liquid pig iron through a lance leads to the emission of copious red fumes in which are suspended dust particles rich in iron oxides which require precipitation. The pilot plant for dust removal installed by I.R.S.I.D. in 1953 at the Mondeville works of the Société Metallurgique de Normandie consists of a dry and wet cleaner in series, the essential feature of the latter being a Venturi scrubber. In industrial use, this installation is able to precipitate more than 99 per cent. of the oxide particles contained in the red fumes. Measurement of concentrations of solid particles in the fumes presents a difficult problem on account of the high temperature, and has made it necessary to devise a special apparatus.

Gas Cleaning in Relation to Oxygen Pre-refining and the Rotor Process at Oberhausen, by Anton Behrendt (Huttenwerk Oberhausen A.G.).

This paper describes the oxygen lancing and Rotor processes in use at Oberhausen, and also the experimental and final plants used to clean the gases given off. The costs of running a bag filter are given and it is shown that these are exceeded by the value of the iron content of the dust recovered. The differences between the dusts from the processes are described and reasons for them are advanced.

Dynamic Dust and Fume Precipitators, by F. Wright (Air Control Installations Ltd.).

The considerations underlying the selection of dust collectors are outlined with a brief discussion of their basic principles. The wide variety of commercial designs available precludes individual detailed descriptions and the present paper deals primarily with " Rotoclone " dynamic and hydrodynamic precipitators.

Cleaning of Fume from Arc Furnaces, by A. S. Hipkin (Visco Engineering Co., Ltd.).

This paper deals briefly with the requirements of the Clean Air Act in relation to pollution by industrial processes. It provides information collected on pollution from furnaces, reviews experience of application of equipment to arc furnaces, and outlines types of fume-cleaning plants available.

Waste-Gas Cleaning Systems at Oxygen Steel Plants, by A. Vacek and A. Schertler (Osterreichische Alpine Montan Gesellschaft, Donawitz).

Conclusion: The required cleaning

effect can be obtained with either a wet- or a dry-cleaning system, and the only factors influencing the decision in favour of a particular system are local conditions and requirements and, of course, installation and operation costs. Local conditions and requirements may be summarized as (a) availability of water, (b) room on site, (c) governmental regulations, and (d) manner of dust utilization. The installation costs of a dry-cleaning system and of a wet-cleaning system including water recirculation and sludge handling are about equal, but the operating costs will show roughly a ratio of 2 : 1 in favour of the dry-cleaning system. Allowing a 10-year period of amortization for the cleaning system, including a waste-heat boiler, the gains on waste heat credits are higher than the operation costs plus amortization factor, and the production costs per ton of steel are therefore lower than they would be without a cleaning system connected with waste-heat utilization.

The Complete Elimination of Dust from Gases at 300-400°C., by H. L. Riley (United Coke and Chemicals Co., Ltd.).

This paper discusses the construction and use of a glass-fibre filter for high-temperature gas filtration, and the possibility of its utilization for other purposes.

The Fulham-Simon-Carves Process for the Recovery of Sulphur from Flue Gases, by T. Kennaway (Simon-Carves Ltd.).

This process consists of the removal of sulphur oxides from flue gases, by scrubbing them with ammonia liquor derived from gas works of coke-oven plants, to produce a solution of ammonium sulphate, sulphite, bisulphite and thiosulphate which, by autoclaving, can be converted to ammonium sulphate and sulphur. An account is given of the development of this process from early work on a central-heating boiler at Cheadle Heath through pilot-plant work at Fulham Power Station, to the present plant on half-boiler scale now operating at the North Wilford generating station. As distinct from existing processes of flue-gas washing, which have been briefly reviewed, the outstanding advantage of the Fulham-Simon-Carves process is that it produces saleable products to offset the cost of operation; it also provides an indigenous source of elemental sulphur.

Measurement of Dust in Flue Gases, by R. Jackson (British Coal Utilization Research Association) and R. A. Granville (British Iron and Steel Research Association).

The work described is limited to the measurement of dust flues and ducts. The related aspects of atmospheric pollution and deposition are dealt with in other papers and are not discussed here. The tests described cover only a small part of the dust-sampling requirements of the iron and steel industry. The purpose of the investigations was to determine the applicability of the techniques to a few problems typical of many existing in the industry, and to provide quantitative information about the emission from different forms of plant. The trials were neither intended to define the emission with complete precision, nor to give guidance on the operation of the plant, but it is felt that the information obtained is accurate, of value to the plant operators, and shows the way by which more extensive data may be obtained.

The Extraction of Sulphur from Coke-Oven Gas and the Manufacture of Sulphuric Acid, by P. R. Purcell and T. H. Williams (Stewarts and Lloyds Ltd.).

This paper describes the plant installed at the Corby coke ovens for the desulphurization of coke-oven gas by the Collin ammonia process and the production of sulphuric acid from the recovered hydrogen sulphite by the Chemiebau wet-contact, sulphuric-acid process. Operation of the plant is discussed and modifications which

(*concluded, page* 129)

THE AIR POLLUTION INVESTIGATION

New Report

The Investigation of Atmospheric Pollution, 28th Report, for the year ended 31st March, 1955. H.M. Stationery Office, 5s. 6d. net.

The last published report of the Investigation, it will be recalled, covered the ten years 1944-54. With the new report annual publication is resumed, and the back-log of work caused first by the war and then by the remarkable growth of the investigation, is steadily being overcome. Even a cursory glance through the report reveals the enormous amount of detailed work that must have been done by the staff of the Fuel Research Station, to whom credit should be paid.

The report shows how the steady increase in the number of co-operating bodies has continued, together with a parallel increase in the number of measuring instruments being maintained. At 31st March, 1955, there were in use:

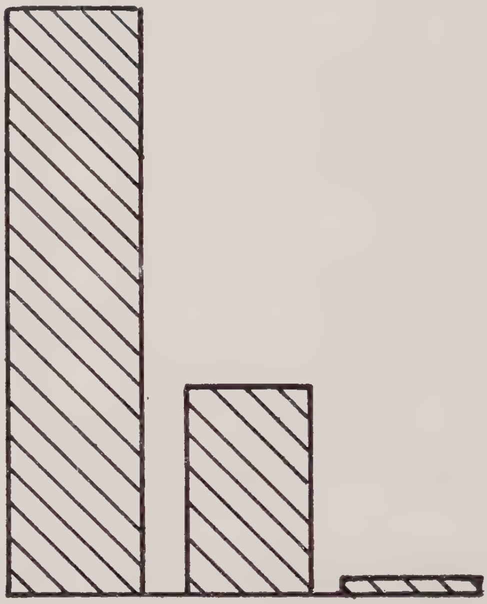
Deposit gauges	773
Daily smoke filters ..	106
Automatic smoke filters ..	7
Sulphur dioxide—	
volumetric	63
lead peroxide	773

The report regrets the relatively small use made of smoke filters and volumetric sulphur dioxide instruments. As is pointed out, the deposit gauge collects grit and other coarse particles, but not the finer smoke particles. A clearer picture of the condition of the atmosphere and of changes over the years would be given by the smoke filter and the volumetric SO_2 apparatus.

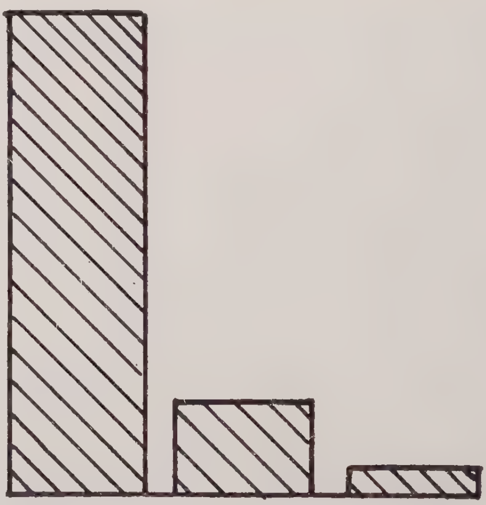
An interesting development is the number of instruments now being maintained by the nationalized industries—the Electricity Authority, the Transport Commission and the Coal Board—and others. These number 498, compared with 1270 maintained by local authorities.

There is no significant change in the general level of pollution—a minor and perhaps adventitious decrease—as shown by the records in this report, compared with the figures for the ten-year period contained in the last report.

The extent to which the air of this country is polluted is clearly shown



Relative proportions of smoke in the air in areas of highest, average and lowest concentrations



Relative proportions of sulphur dioxide in the air (lead peroxide method) in areas of highest, average and lowest concentrations

by tables which give averages for the highest, average, and lowest deposits and concentrations. Thus for smoke suspended in the air there is, over the whole year, a ratio for the three groups of 53 : 18 : 1. If we take "low" to mean "clean," or relatively so, the average atmosphere is 18 times as dirty as it might be, while in the worst areas the dirt index rises 53 times.

Similar ratios are shown for deposited matter and for sulphur dioxide by both the volumetric and lead peroxide methods. With sulphur dioxide, however, the ratios are not so wide, probably because no observations are made in the cleanest areas.

Other F.R.S. Activities

Brief details are included in the report of current investigations by the Fuel Research Station aimed at reducing pollution.

Work on a process for removing the oxides of sulphur from flue gases, undertaken in collaboration with Messrs. Simon Carves and the Central Electricity Authority, was carried to a small pilot-plant stage at the Research Station. Results were sufficiently promising to justify the installation by the C.E.A. of a large pilot plant to treat $1\frac{1}{2}$ million cubic feet of gas per hour at Nottingham power station. This is now in operation.

Smoke from reheating furnaces used in steel manufacture is still a serious source of pollution, and it has been held by many in the industry that a smoky atmosphere is necessary to produce good steel. The problem has been studied at Sheffield University as part of the research programme of the Fuel Research Board. Results have shown that it is possible to produce steel of the highest quality without the emission of smoke. The application of these results could lead to substantial improvements in the air of the Sheffield and Rotherham areas.

There are still about 12 million old-fashioned firegrates in use, on which the only solid smokeless fuel which will burn is low temperature coke, now in short supply. It has been found possible to produce, at a price a little higher than that of ordinary coke, a coke with which fires in old-fashioned grates can be lit and maintained. This coke is being produced commercially in standard gas works plant, and the process is capable of considerable extension.

The boiler doors designed at the Station to eliminate smoke from hand-fired natural draught boilers are being installed at an increasing rate, but there are still many boilers in use which could be fitted with advantage. Data have been published from which a similar smoke-eliminator door has been designed for forced draught boilers. An industrial firm is now making these doors under licence.

Two items of research have been started on the pollution of air by the exhaust gases of motor vehicles. The first is the investigation of a patented device for completing the combustion of unburnt gases leaving the engine. The second line of research is the detailed examination of the organic constituents of exhaust gases and the variation of their concentrations with engine conditions.

Iron and Steel Conference—*concluded*

have been incorporated are described. Finally, recent developments of the process are briefly reviewed.

Mitigation of Smoke, Dust and Grit at Coke-oven Plants, by G. W. Lee and J. P. Graham (British Coke Research Association).

This paper outlines the present scale of carbonization and its connection with the iron and steel industry and the domestic market. Coke-oven plants are affected by the Alkali, etc., Works Regulation Act of 1906 and the Clean Air Act of 1956. Fundamentally, new processes are unlikely to be developed in the foreseeable future, so the immediate problem is the mitigation of pollution by existing coke-oven plants. The sources of atmospheric pollution at coking plants are described in detail, and recommendations are made for reducing them.

From our Photo-Library No. 30 *F. Huntley Woodcock*

Northern Landscape

Trade Publications

W. C. Holmes and Co., Ltd., Huddersfield, have issued a new folder (No. 72) which briefly describes the range of dust collection and control plant they manufacture—electrical precipitators, multi-wash system, multi-cell cyclone, and electronic air filters.

The Sturtevant Engineering Co. Ltd. (Southern House, Cannon St., London E.C.4), have issued a new edition (No. 7009) of their handbook on Electrostatic Precipitation. This is a well-illustrated book of 72 pages, which includes full descriptions of the principles involved, practical information and details of the types of precipitators and the purposes for which they are suitable.

Combustion Equipment Ltd. (61 Belsize Lane, London, N.W.3) have sent us a new pamphlet describing the Cory Grit Arrester, Mark II, which is an improved version of the original arrester. It has been developed in collaboration between William Cory and Sons Ltd., Combustion Equipment Ltd., and the British Coal Utilization Research Association. The arrester is fitted to the top of the chimney and although primarily intended for steel chimneys it may also be applied to low brick chimneys in good condition. The chimney gases are caused to spin by the blades of a gas spinner, and the solid particles are flung outwards to the periphery and are caught by a reflector ring at the top of the arrester. They fall immediately into a collecting chamber, falling through two pipes to one or two hoppers. A collectance efficiency of over 90 per cent. is stated for the particle range classed as grit in the Beaver Report (i.e., 76 microns or over).

The arrester has been fitted to vertical, shell type and small water tube boilers and has also been applied to wood waste disposal plants.

PROGRESS WITH GAS AND ELECTRICITY

New Annual Reports Reviewed by A. J. Cousin, M.Inst.F.

Eighth Report and Accounts of the Gas Council for the year ending 31st March, 1957 (H.M.S.O. 8s. 6d.)

THE Report, which incorporates the reports of the twelve Area Boards, themselves the statutory manufacturing and distributing authorities, shows that the industry continues its efforts to develop gas supplies alternative to those produced by the carbonization of high grade coking coals, and generally to increase its efficiency to off-set the rising costs of materials and services. The interlinking schemes have been extended and many small and inefficient gas-making plants have been closed down.

Plant to the extent of 102 million cubic feet a day was installed while old and less efficient plant equivalent to 75 million cubic feet a day has been abandoned. As a result the thermal efficiency increased from 76·8 to 77·8 per cent. New plant installed included six for the gasification of oil producing 12·5 million cubic feet a day, and it is the intention during the next two years to establish some thirty additional plants producing in all 113 million cubic feet of gas a day. The gasification of oil naturally will not produce coke; but to the extent that oil gasification is in substitution for water gas, the coke for sale will not be reduced.

The Gas Council continues its research into the complete gasification of low rank coals by hydrogenation under pressure, which may contribute to the economical transmission of gas at high pressure.

Arrangements have been made by the North Thames and Southern Boards respectively to take 25 million and 17 million therms per annum of "tail" gas from the oil refineries of the Shell Company at Shellhaven and the Esso Company at Fawley, with a resulting saving of coal of some 365,000 tons.

Search continues in Sussex, Yorkshire and Scotland for natural gas, and that obtained from Cousland near Dalkeith is supplied to Musselburgh.

Gas produced by coke ovens and supplied to the Area Boards increased from 409 million to 456 million therms.

Arrangements have been made by several Boards to take methane collected from coal seams in colleries in their areas. Research is being pursued as to the possibility of importing liquified methane from the U.S.A.

Carburetted water gas made during the year was less by 89 million therms than in 1956, owing to the necessity to save oil.

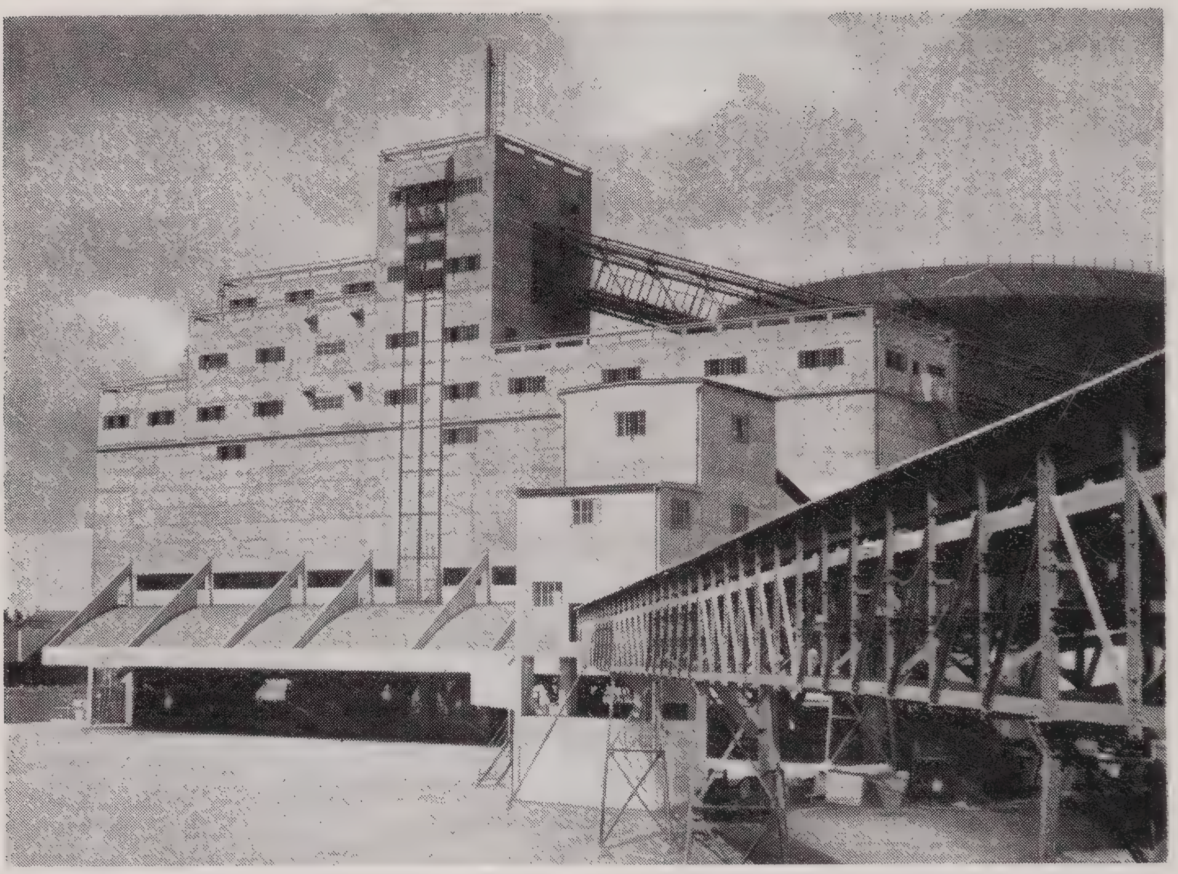
In order to meet peak demands, liquified butane or propane is being utilized.

Integration

The integration of gas undertakings has continued and manufacture has ceased at 77 stations. Of the 1,050 manufacturing plants taken over on vesting day, 611 remain in use. The length of mains in use during the year amounted to 90,350 miles, an increase of 2,050 miles.

The 28,550,000 gallons of crude benzole were extracted and 13,679,000 were refined. 82,700 tons of sulphate of ammonia were produced, and increased interest is being shown in the use of ammoniacal liquor as a fertilizer.

The Gas Council has in mind the demands that may be made upon it for increased supplies of gas and solid smokeless fuels arising from the Clean Air Act. As soon as it is



The coke grading, storage and loading plant at the Garston works of the North Western Gas Board in Liverpool. The plant can handle 120 tons of coke an hour, and over 2,000 tons of graded coke can be stored in the concrete bunkers. (*From the Gas Council Report*)

possible to assess the rate at which smoke control areas will be established, the industry will be able to plan ahead, although there are ample supplies of smokeless fuels for a serious beginning. Some additional $2\frac{3}{4}$ million tons could be produced from existing plant, and it is anticipated that $4\frac{1}{2}$ million tons of the 7 million tons used by large users could be diverted to the domestic market were this necessary. "Cleanglow," "Phimax" and "Grancole," active cokes from low rank coal, are made by the North Thames, the North Western and the Scottish Boards respectively. A specification for two grades of domestic coke will be passed to the British Standards Institution.

In addition to the research carried out on the production of gas referred to above, the Council continues its research into the purification of gas with a view to the evolution of a liquid purification process, the treatment of effluent refractory materials, and on space heating, cooking and water heating apparatus, and on coke-burning apparatus.

Area Boards

The Scottish Board is negotiating for additional supplies of methane from collieries, and the production of gas from residual oil products at Grangemouth Refinery is under consideration.

The North Western Board has erected at Wallasey a plant for the complete gasification of coal which is producing 184 therms of gas per ton of coal. The Board's total gas-making capacity amounts to 364 million cubic feet, 52 million cubic feet more than vesting day.

The North Eastern Board envisages taking increased quantities of gas from coke ovens, and has now made arrangements for supplying 18 million gallons of ammoniacal liquor by main to chemical works at Wakefield.

The East Midland Board has erected

two catalytic oil gas plants at Sheffield and Rotherham respectively of 10 and 6 million cubic feet a day. The completion of the final link between Sheffield and Chesterfield of the " backbone " main from Doncaster to Northampton, is associated with possible additional supplies of coke oven gas, and is under consideration.

The West Midland Board has two catalytic oil gas plants under construction at Bilston and Coventry. A much needed Lurgi complete gasification plant, proposed to be erected near Birmingham has been delayed by absence of planning permission. 2,000 yards of a pre-stressed 27-inch concrete main has been laid by the canal at Willenhall.

The Wales Board now takes 81 per cent. of its gas from coke ovens and as a result had to carbonize only 218,000 tons of coal. Both the North and South Wales grids were extended.

The Eastern Board includes five of the New Towns and the sales of gas to them amounted to four million therms. A 2 million cubic feet a day complete gasification plant for low rank coal was erected at Watford and a catalytic oil-gasification plant of 3·7 million cubic feet a day was erected at Ponders End.

The North Thames Board has completed the fifth battery of coke ovens at Beckton, and an Onia-Gegi plant for gasification of heavy oil at Fulham which with other improvements brings gas-making capacity to 425 million cubic feet a day.

South Eastern Board is erecting a plant on the Isle of Grain for gasification of oil residues from the refinery of the British Petroleum Company. The capacity of the East Greenwich Works is being raised to 81 million cubic feet a day.

Southern Board has increased the capacity of the new Kingston Works at East Cowes to enable the whole requirements of the Isle of Wight to be met from these works. There is in prospect a linkage between Southampton, Portsmouth and Bournemouth and a " backbone " main from Southampton to the trunk main from Reading to Cowley.

The South Western Board inherited 108 manufacturing gas plants, 12 were closed during the year and manufacture is now centralized in 36 stations. When the final link of 10 miles from Totnes to Ivybridge is completed, a continuous main linkage will exist from Evesham to Penzance, a distance of 242 miles. At Gloucester three oil gasification plants have been erected, one of which produces carbon black.

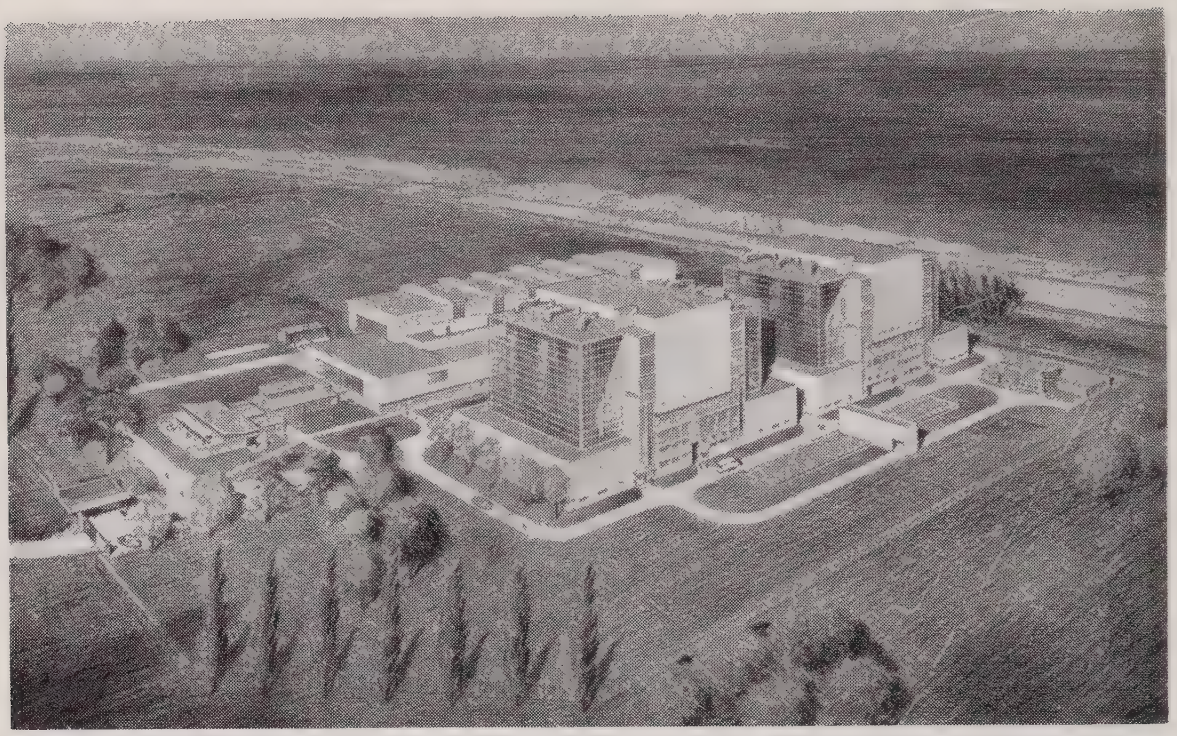
All the Area Boards made a profit amounting in the aggregate to £3,803,856, after allowing £19 million for interest and £23·5 million for depreciation, etc. The gross income of the Area Boards amounted to £369 million. There were nearly 13,000,000 consumers and the average revenue per therm was 19·1d. compared with 17·7d. in the previous year.

Ninth Annual Report of the Central Electricity Authority for the year ending 31st March, 1957 (H.M.S.O. 10s. 6d.)

The Central Electricity Authority is a statutory corporation which owns and operates the power stations and the interconnecting transmission lines known as the grid. It is divided into eleven generating divisions. The 12 area Boards, also statutory corporations, purchase electricity from the authority and distribute it to consumers.

In Scotland the electricity supply is owned and operated by the North of Scotland Hydro Electric Board in the North of Scotland, and the South of Scotland Electricity Board in the South of Scotland.

A Bill that received Royal Assent on the 17th July, 1957 provided for the dissolution of the Central Electricity Authority and the establishment of a Central Electricity Generating Board and an Electricity Council, and for allocating the duties of the Authority between the Generating Board, the Council and the Minister.



Artist's Impression of the Bradwell Nuclear Power Station, Essex (*From the C.E.A. Report*)

During the year under review 79,500 million units of electricity were generated and 67,500 million units were sold to consumers, the number of which increased by 390,000 to over 14½ million. Since vesting day, the number of consumers has increased by 3,750,000 and the sales of electricity have more than doubled.

The average price paid for electricity was 1·46d. per unit, 4·7 per cent. higher than that for the previous year, 28·4 per cent. above that of 1947-8 and 38·1 per cent. only above that of 1937-8.

At the end of the year the Authority owned 262 power stations with an installed generating capacity of 22,571,886 kilowatts and a maximum output capacity of 20,644,000 kilowatts.

New generating plant brought into commission among 33 stations amounted to 1,828,000 kilowatts output capacity. The stations included three new steam stations, Castle Donington (near Derby), Hams Hall C, and Tilbury A. Seven steam and eight diesel uneconomic stations were closed down.

The Authority had planned an increase in generating capacity of 44 per cent. during the calendar years 1957 to 1962, equivalent to an increase of output capacity of 9,000,000 kilowatts including 1,275,000 kilowatts from nuclear plant.

The 200,000 kilowatts generating sets referred to in the Authority's report for the previous year have become established and it is proposed to erect sets of 275,000 kilowatts with a single line turbine and one of 550,000 kilowatts with a double line turbine. Sets of 200,000 kilowatts with water-cooled stator conductors are proposed for two new stations.

Thermal efficiency of generation has increased to 24·93 per cent. as compared with 24·35 per cent. during the previous year and 20·91 per cent. in 1947-8. The progressive improvement in thermal efficiency since vesting day has resulted in a saving of some 31 million tons of coal.

The Grid

The grid, including the 275,000 volt supergrid comprised 5,500 route miles of main transmission lines and 362 grid substations, with a transformer capacity of 28,680,000 kVA. The

grid enables fuller use to be made of high efficiency generating plant, less efficient plant being brought into use only to meet peak loads.

Works cost of electricity sent out from steam stations increased from ·605d. in 1955-6 to ·649d.

The Authority used 41·59 million tons of coal and 811,000 tons of coke breeze, 282,000 tons of oil, 60,000 tons of other fuels.

In addition to the Calder Hall Station erected by the Atomic Energy Authority and now in operation, the Authority has in view three nuclear stations, Bradwell, Essex, Berkeley, Gloucestershire, and Hinkley Point, Somerset. The first two stations will each have two natural uranium, carbon dioxide-cooled graphite-moderated reactors. Bradwell will have an output capacity of 300,000 kilowatts from six turbo-alternators, each of 52,000 kilowatts, driven by steam of 755 lb. per sq. in. and 704°F. The Berkeley station will have an output of 275,000 kilowatts from four turbo-alternators, each of 80,000 kilowatts, with steam at 306 lb. per sq. in. and 612°F. The third plant at Hinkley Point will probably have a net output of some 450,000 kilowatts. As a long term policy it is hoped that some 6,000,000 kilowatts of nuclear plant will be in operation by 1965. The capital cost is, at present, in the region of £145 per kilowatt, roughly three times that of a conventional steam station.

In conjunction with the National Coal Board, the Authority proposes to erect a pilot generating plant of 3,750 kilowatts, driven by gas produced by the underground gasification of coal.

Construction of the hydro-electric plants at Ffestiniog and Rheidol was suspended, owing to restriction on capital expenditure.

Atmospheric Pollution

The authority has continued the efforts to decrease atmospheric pollution and has improved the design of grid collecting plant. The policy adopted of providing a small number of high chimneys ensures that hot combustion gases are discharged into the upper atmosphere. It has continued the policy of measuring dust deposits and sulphur content of the atmosphere in the neighbourhood of power stations. Flue gas washing plant has been in operation at Bankside and Battersea and the experimental plant at Nottingham for washing flue gases with ammonia liquor has been completed. Dry methods of absorbing sulphur from flue gases have been examined, with a view to removing sulphur without impairing the buoyancy of the flue gases.

The present plan for electrification of Railways will require 300,000 kilowatts and a consumption of some 1,400 million units a year. Plans are under discussion for the supply of 25,000 volt single-phase alternating current for the electrification of Euston-Manchester and Liverpool and for Colchester-Clacton and Walton.

Electricity supplies were provided to some 13,000 farms during the year.

The total number of consumers on non-standard voltage at the end of the year was 2,020,686 a reduction of 54,750.

A cross-channel connection with Electricité de France is under consideration probably in the form of a single submarine cable at 200,000 volts D.C. capable of transmitting 160,000 kilowatts.

The combined net revenue of the Authority and the twelve area Boards for the year amounted to £11,718,915 from a gross revenue of £422 million. Capital expenditure incurred during the year was £130 million for the Authority and £75 million for the 12 Boards.

Bristol Meeting

At a recent meeting of the Wessex branch of the Coal Industry Society, to discuss the Clean Air Act and the coal trade, the film " Guilty Chimneys " was screened, and the two speakers, Mr. F. J. Redstone, C.P.H.I., Bristol, and Mr. K. M. Wall, of West Bromwich, were plied with questions.

NOTTINGHAM HOSPITAL CASE

High Court Decision

The Queen's Bench Division of the High Court of Justice (before the Lord Chief Justice, Mr. Justice Donovan and Mr. Justice Havers), on 16th and 17th October, 1957, heard the appeal of the Nottingham Area No. 1 Hospital Management Committee against an order of Nottingham justices. This was made on a complaint by the Town Clerk of Nottingham under the Public Health Act, 1936, to abate a nuisance arising at the General Hospital, Nottingham, from a chimney emitting black smoke.

At the hearing before the justices a preliminary submission was made that under section 106 of the Public Health Act, 1936, the justices had no jurisdiction to hear the case since the hospital was Crown property occupied for the public service of the Crown. The justices were of the opinion that they had jurisdiction and proceeded to hear the case. They found that a serious nuisance existed owing to the chimney emitting black smoke and had existed for upwards of seven years. The causes of the nuisance were failure to install suitable plant and sufficient boiler and grit arresting plant, and failure to keep the steam load within the rated capacity of the boilers. Notice to abate had been served on 12th July, 1955.

Section 106 of the Public Health Act, 1936 states that if it appears to a local authority that a smoke nuisance "exists on any premises occupied for the public service of the Crown, they shall report the circumstances to the appropriate Government Department, and, if the Minister responsible for that department is satisfied . . . that such a nuisance exists, he shall cause such steps to be taken as may be necessary to abate the nuisance and to prevent a recurrence thereof." A similar provision is included in the Clean Air Act, 1956.

For the appellants it was stated that the trouble and nuisance had been completely cleared now, and that it had cost over £80,000 to put it right. The Lord Chief Justice asked: "Would it have been put right if proceedings had not been taken?"

It was submitted that the Minister owned the hospital in trust for the Crown, and the public service of the Crown, and was occupying it through the committee just as through a caretaker. This was not the only case and it had wide implications.

The Lord Chief Justice—"I hope that does not mean that all the hospitals taken over by the Minister are belching out black smoke. That would be inconsistent with the duties laid down in the National Health Service Act."

Counsel said that steps were being taken to bring up to modern standards all the hospitals which were vested in the Minister. The point here was the purpose of the occupation, and whether the hospital was occupied for the purposes of the public service of the Crown.

Judgment

The Lord Chief Justice said that the point raised by the special case was whether the justices had jurisdiction. He was bound to say, with some regret, that he had come to the conclusion that the justices had no jurisdiction and that the appeal would have to be allowed. Had it not been that the hospital was a hospital under the National Health Service Scheme—had it remained a voluntary hospital for example—the complaint laid would have been a cheap and simple method of dealing with the matter, for it did away with expensive actions, but the Minister had taken the point and the Court had to decide it. The Minister

submitted that a hospital vested in the Minister constituted " premises occupied for the public service of the Crown."

The Public Health Act, 1936, set out certain matters which were statutory nuisances and among them was smoke nuisance—the emission of large quantities of black smoke. The Act provided that, if such a nuisance existed from a building other than a private dwelling, summary proceedings could be taken and an application made to the justices for an order compelling the owner to abate the nuisance. For some reason there was a provision in section 106 of the Act that where a smoke nuisance existed on " premises occupied for the public service of the Crown," the local authority should report the circumstances to the appropriate Government Department and, if the Minister was satisfied that such a nuisance existed, he should cause steps to be taken to abate it.

It seemed clear, therefore, that if it was alleged that a smoke nuisance existed in such premises, the simple and speedy procedure which could be taken against private persons could not be taken. But section 106 did not, as his Lordship apprehended it, prevent the local authority from bringing an action for an injunction or abatement in the High Court. The question the Court had to decide was whether the hospital came within the description of " premises occupied for the public service of the Crown."

By section 3(1)(a) of the National Health Service Act, 1946, it was the duty of the Minister to provide hospital accommodation, and section 6 provided for the transfer to and vesting in him of certain hospitals. Section 7 of the Ministry of Health Act, 1919, provided that all land vested in him should be held in trust for His Majesty for the purposes of the Ministry of Health. Section 11 of the 1946 Act provided that the Minister should constitute regional hospital management committees to manage and control individual hospitals.

There was no doubt that the occupiers of these premises were the hospital management committee, who were carrying on duties imposed on the Minister. The hospital premises were such as were required and created by statute, and, in his Lordship's opinion, it was proper to say that the provision of hospitals under the National Health Service Act, 1946, was for the public service of the Crown.

Mr. Justice Donovan and Mr. Justice Havers agreed.

Counsel for the appellants asked for the appeal to be allowed with costs.

The Lord Chief Justice said that counsel had said this was a case of some importance; and that the Minister had now put the matter right and wanted a decision on the question of principle. He had taken a long time about it. His Lordship refused to make any order for costs.

Fuel Efficiency Diary

H. O. Quinn Ltd. (151 Fleet St., E.C.4), publishers of technical diaries, have broken new ground for 1958 with an Industrial Fuel Efficiency Diary. Compiled and edited by a qualified engineer concerned with combustion and industrial steam raising, Mr. H. B. Locke, the diary contains a remarkable amount of useful information in a compact and pocketable form. Fuels, combustion, steam raising, instruments, heat transfer, steam usage and many charts, are included in the contents. There is also, for example, information about City and Guilds examinations and other educational information, and reproductions of the Ringelmann chart shades. The more general diary section, including coloured maps, is of good standard, and altogether the diary should be of considerable value to all concerned with industrial fuel. Smoke inspectors should find it helpful in many respects. The price is 10s. in real pigskin, or 11s. 6d. in real calf, postages included.

SMOKE PREVENTION ABSTRACTS

293. Clean Up Hot Gas Streams. Silverman, L. (Chem. Engng. News, 1957 (May 20), **35**, 98). Slag-wool filters can remove both particles and acidic gases from open-hearth fumes at temperatures up to 1,000°F. With multiple layers, the collection efficiency was as high as 99 per cent., and tests carried out on a pilot system showed that it could clean up to 900 cu. ft. of gas per minute with an efficiency of 90 per cent. (B.C.U.R.A.).

294. The Design of Domestic Open Fires. Darby, D. K. (J.Inst. Fuel. **30**, 426, August, 1957). The paper sets out the reasons for recognized design principles for inset open fires without boiler or convection, and then examines these together with other design considerations which are still the subject of discussion and research when an inset open fire is combined with a back-boiler. The paper also examines design points to be considered when an appliance incorporates provision for heating by convection, or chimney throat restriction, or underfloor air supply for combustion, or a combination of two or more of these features. Only open-fire appliances including openable stoves are examined although many points discussed may also be applicable to closed stoves and domestic boilers.

295. The Worker with Chronic Chest Disease. Hughes, J. P. W. (Paper read to Royal Society of Health symposium on the Health of the Worker, with reference to the Control of Dust and Respiratory Diseases, 13.11.57). The author describes some of the main characteristics and causes of chronic bronchitis, and speaking of the latter, says that apart from infection, atmospheric pollution, whether general as in industrial towns or (mainly) private as in smoking, is almost certainly the greatest causal factor. He points out that evidence is accumulating that polluted air acts as a chronic low-grade bronchial irritant and is of first importance in chronic bronchitis. He then goes on to mention a number of authorities and their findings concerning the relationship between chronic bronchitis and air pollution, considerable emphasis being laid on the burning of coal as a factor in the incidence of the disease. After some discussion of the medical management of the disease, the author stresses the importance of cleaning the air, using the Clean Air Act as a first step.

296. Smoke Control on Shell Boilers. Lewis, E. T. (Steam Engineer. **26**, 363, August, 1957). This article describes the development of a simple but effective aid to the boiler fireman. In a plant consisting of six boilers of Lancashire type, smoke was eliminated and performance improved by the use of a smoke indicating light. This is an adaptation of the system in use in marine boilers, where an electric light shines through the flue to a mirror, which reflects the light down to the stokehold deck. Such a system was somewhat difficult in the case of a Lancashire boiler, owing to the layout of the flues, but the problem was solved by providing each light with an inverted periscope so that the light shone down from above the flags into the side-flue and on to a mirror placed at 45 degrees, which reflected the light towards a sight hole in the front cross-wall. The use of these lights enabled the firemen to adjust the draught so finely that not only was smoke eliminated, but other faults in the operation and layout could be detected. This installation was for boilers burning coal-tar fuel, but similar success was obtained on coal-fired installations. This system has now been incorporated in a British Standard " Recommendations for Simple Smoke Viewers " (B.S.2741/1957).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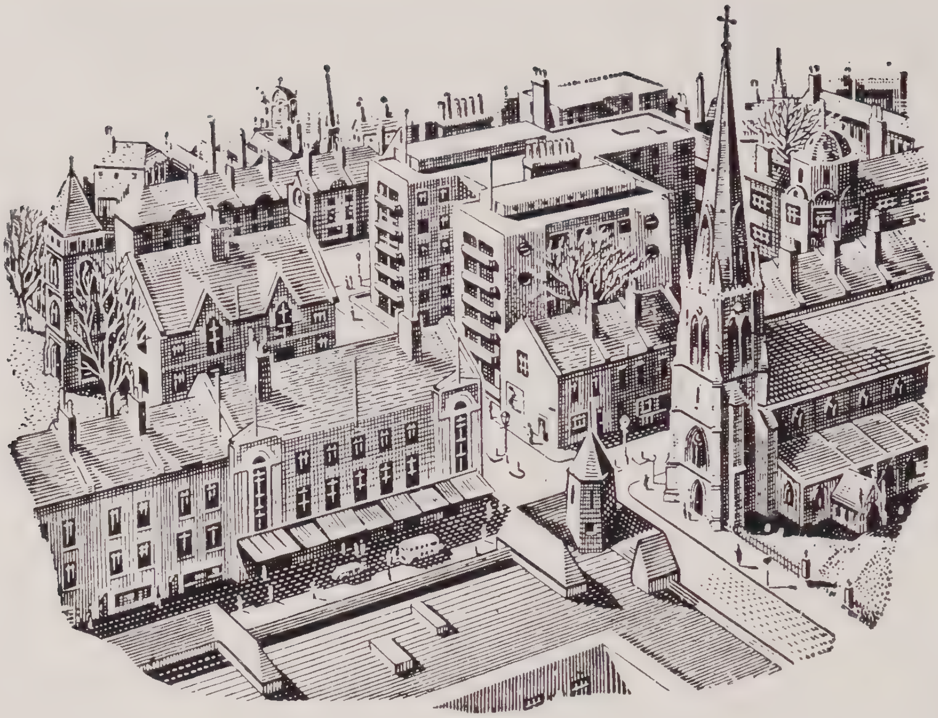

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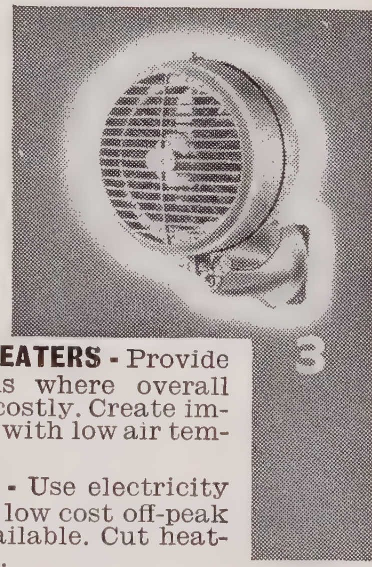

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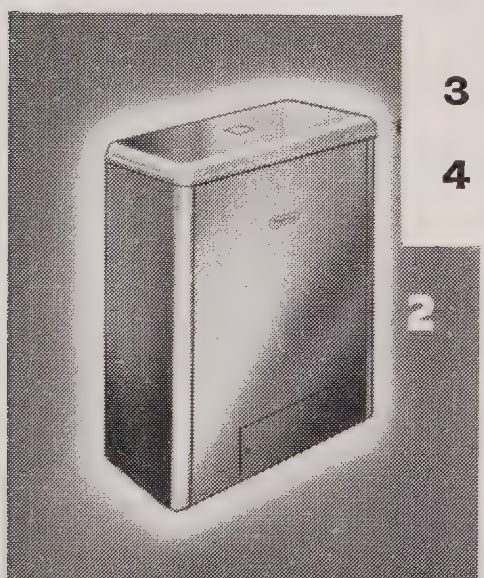

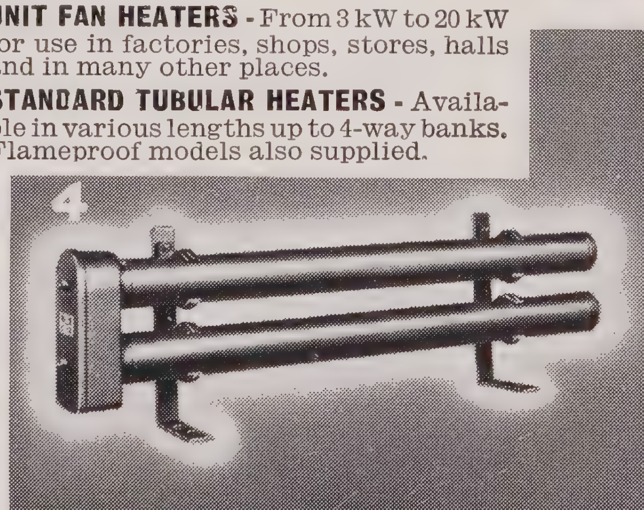

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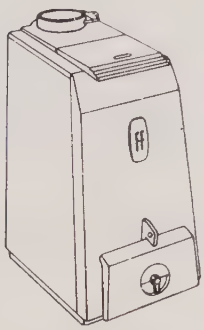

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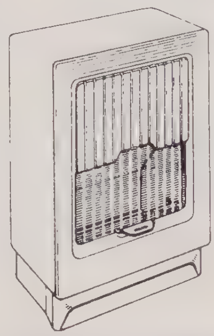

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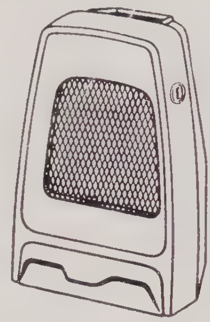
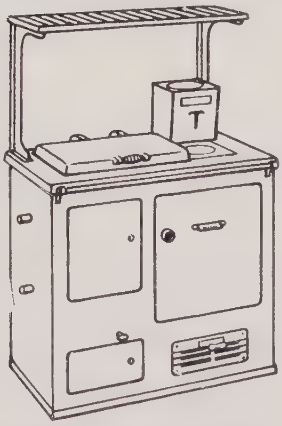


SWIFT FIRE



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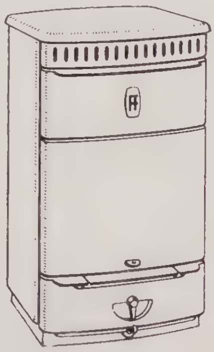

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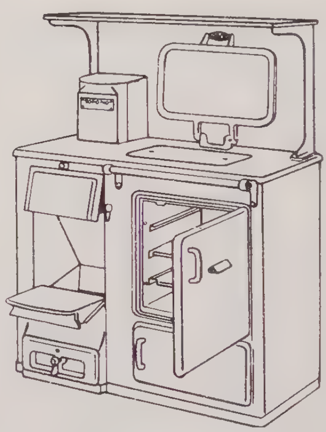

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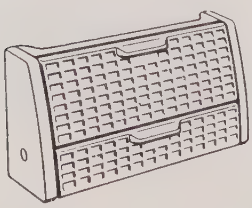

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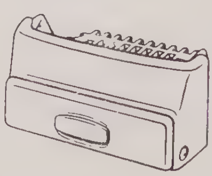

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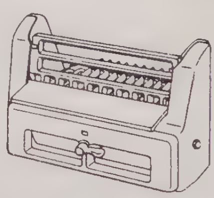

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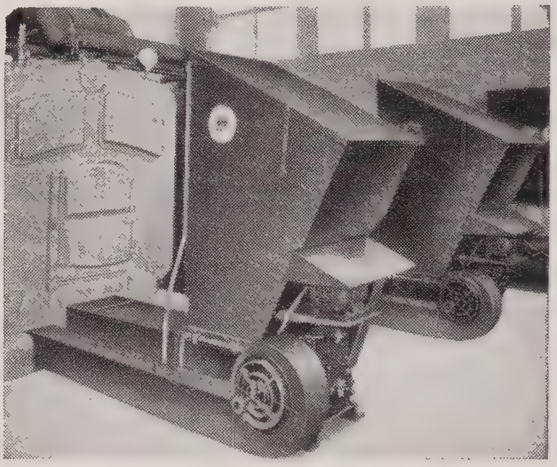

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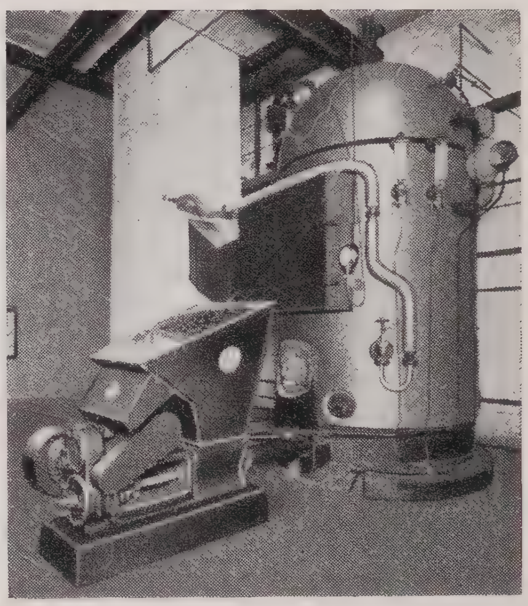
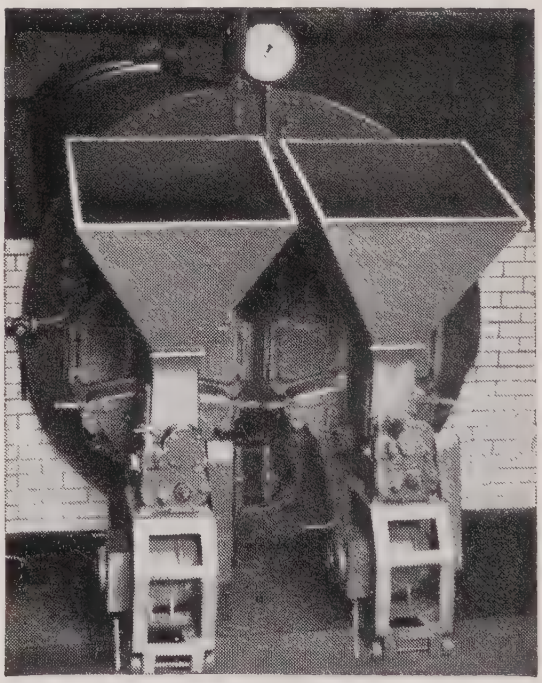


Vertical Steam-raising Boilers.



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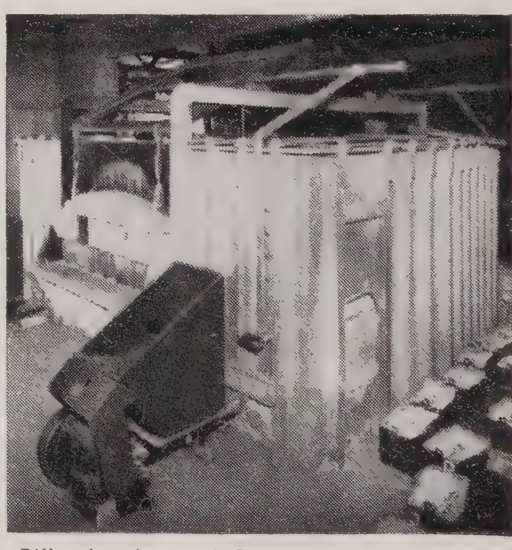

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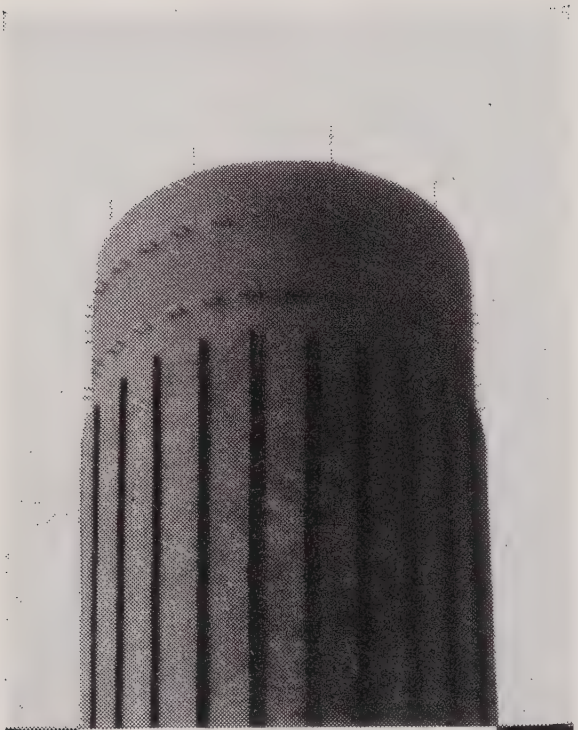

Unretouched telephoto views of the chimney cap at Fleetwood power station from (left) the north and (above) the south.

Right-from the start

At the Fleetwood power station of the Central Electricity Authority, where the first boiler was commissioned in May 1955, the first two boilers have each steamed for some ten thousand hours. During this time there has been no sign of any dust build-up on the chimney cap—shown here in unretouched photographs. The total number of hours during which any part of the electro-precipitator has been out on fault is less than 24 and at no time has the complete precipitator been out on fault.

This is a striking testimony that the Simon-Carves electro-precipitators, which extract the flue dust produced by the three boilers at the station have worked effectively from the time they were first brought into operation.

Because their design is based on long experience of electro-precipitation techniques coupled with up-to-date knowledge of the latest developments, Simon-Carves electro-precipitators are right —from the start.

99·36% EFFICIENCY

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by Simon-Carves Ltd

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SC175

SMOKELESS AIR

JOURNAL OF THE
NATIONAL SOCIETY FOR CLEAN AIR

No. 105 ⋆ SPRING 1958 ⋆ 2/-

In this Issue

How long is the life of the dirt and disease spreading chimney stack? Not long surely, for smokeless coke and gas will provide heat for any purpose more efficiently and economically.

Issued by the Gas Council

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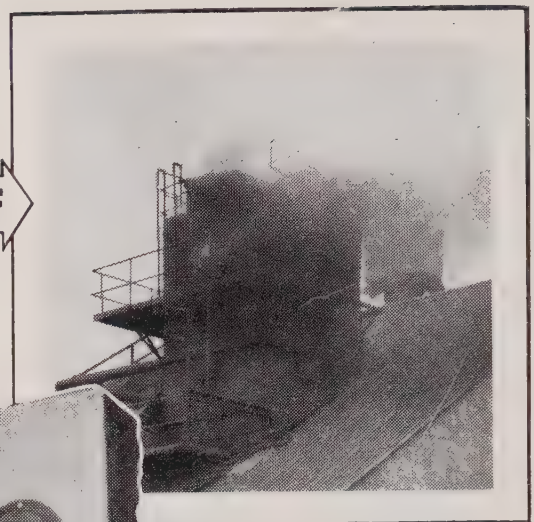
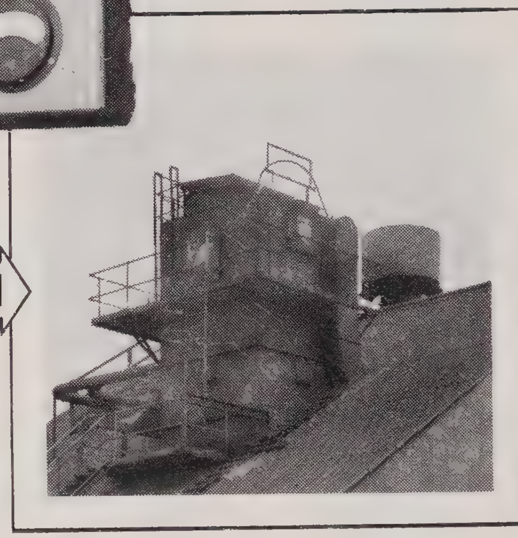


A button is pressed

PRECIPITATOR ON



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MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership application form will be sent on request.

AIR POLLUTION NEWS

The Society's new Bulletin, published as required for the purpose of providing members and others with up-to-the-minute news of importance on all aspects of air pollution and the campaign for clean air.

APN will be sent free of charge to members and representatives of members *on request*, and to others on payment of postages account.

SMOKELESS AIR

Vol XXVIII No. 105 Spring 1958

Principal Contents

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SMOKELESS AIR is published quarterly by the National Society for Clean Air at Palace Chambers, Bridge St., London, S.W.1. Tel.: TRAfalgar 6838-9 (Editorial and Advertising). Issued gratis to Members and Representatives of Members. Subscriptions rate for SMOKELESS AIR only, 8s. per annum, post free.

Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

The First of June

ON 1st June the Clean Air Act will go completely into operation. On that day the provisions that are of most direct concern to industry will come into force, and the control of both dark smoke and grit and dust will begin. At the time of writing there is no information about the regulations that are required by the Act, such as the time to be permitted for dark smoke emission. It is therefore not yet possible to make much detailed comment, although there are one or two points that may be emphasized.

First, there seems to be a little nervousness, here and there, in industry, about what is likely to happen on 1st June. There are no doubt some concerns which deserve to be made nervous, but we do not foresee the Act being applied in any ruthless spirit. The authorities have to feel their way in the use of it, and in any case they are likely to regard the use of the new powers they possess as being the last step after all persuasion has failed. There is not likely to be a rush of court cases, although a few may be useful, even if only to show how the Act works in practice, and what happens when, for instance, the defence of unsuitable fuel is advanced.

More details of the Appointed Day Order are given on another page.

Temporary Exemptions

A word of explanation and warning must be made about section 2 of the Act, which appears to be widely regarded as giving exemption from proceedings for seven years. Even some local authorities appear to have been confused about this, and industry may have been misled by an erroneous statement in one leading newspaper. The matter is of such importance that it is desirable to explain the position as clearly as possible.

If proceedings are taken for dark smoke emission it is a *defence*, for seven years from the passing of the Act (i.e., to 1963) to prove (*a*) that the contravention was due to the nature of the building and equipment and not to failure in use or maintenance, AND (*b*) that it had not been practicable to make the alterations necessary to prevent the emission of dark smoke. This is not an exemption, but only a defence that to succeed must prove both (*a*) and (*b*). The reason for the provision is to give time for alterations which it may not have been practicable to complete, but it will clearly be necessary to show why it has not been practicable. What was in mind when the clause was drafted was that there might be such a demand for new plant and equipment that it would be impossible for everyone to secure delivery and installation in good time. The implication is that the attempt had been made and that for good reasons it had so far failed.

The " exemption " comes in only if an application is made to the local authority and if the authority is satisfied that it has in fact been impracticable to make the necessary alterations. Once again it will be

necessary to show why it has been impracticable. The authority *may* then issue a certificate accepting the application, and if it does this would be conclusive evidence under defence (*b*) above. The certificate would not, however, prevent proceedings being taken if the authority considered that the emission was due to failure in use or maintenance. The exemption certificate is therefore limited in its scope, and it is also limited in time to one year, after which further application would have to be made showing why it was still impracticable to make the alterations.

The section provides a fair and reasonable defence if contravention is due to time trouble, but its scope is clearly and narrowly defined, and it is important that it should be understood that the seven years—nearly two of which have already gone—are by no means years of grace during which nothing need be done.

A Request

How many applications for exemption certificates under section 2 have in fact been made, or will be made as the Act swings into action? It is a matter of interest and maybe of some importance to local authorities. We would be grateful for information from any of our local authority readers who have knowledge of such applications and how they have been received and dealt with.

A Message from the Minister

The National Society for Clean Air is now well and truly launched, and a gratifying number of letters of good wishes and commendatory press notices have been received. Among these, and sent in response to a greeting card from the President that announced the birth of the new Society, was a message from Mr. Henry Brooke, Minister of Housing and Local Government. The Minister writes:

I was very pleased to receive your New Year Card with its message of goodwill from the National Society for Clean Air.

1958 *will be an important and eventful year for the clean air movement, because it will see the whole of the Clean Air Act in force, and the first smoke control areas established under the Act in operation. I congratulate the Society upon entering the New Year under its new title, which so rightly recognizes that our objective today is not only smoke abatement but the suppression of all forms of air pollution. I hope that its new constitution will prove an added source of strength to the Society, and that all possible success will attend its activities during* 1958.

That Purchase Tax

The anomalies of purchase tax are being widely ventilated at the present time, with Mr. Gerald Nabarro leading the assault in Parliament as assiduously as he led it on behalf of clean air and thermal insulation. It is not generally realized that progress to clean air is being thwarted in some respects by purchase tax being imposed on gas and electrical heating appliances. As the Ministry of Housing and Local Government is pressing forward so admirably to make the Clean Air Act successful it is a pity that their policy should be opposed, perhaps unwittingly but nevertheless quite seriously, by the Treasury.

As an example of what happens we quote from a letter, from a prospective member, who was replying to our invitation to subscribe to the Society:

" I am just now installing at home a gas-fired boiler to replace one which was fired with so-called anthracite. On this new boiler I have to pay a purchase tax of more than £30. If I were to buy a boiler which used anthracite or coke, I would not have to pay any purchase tax on it. But by burning coke or anthracite I would be producing about 25–30 times more sulphur dioxide than by burning gas. By burning coke or anthracite I would also be producing a certain amount of carbon monoxide, which would not be produced by burning gas.

" You will thus appreciate that I am

being penalized financially by the Government for my small contribution towards reducing atmospheric pollution. The amount of the financial penalty thus inflicted on me is equal to many years' subscription to your Society."

It should also be known that electrical storage heaters are free from purchase tax only on condition that they are not sold for domestic use.

Coming Events

Members and representatives will be receiving an invitation, with full details, to a joint meeting to be held in London on 13th May of the Royal Meteorological Society and the N.S.C.A. It will take place in the new Agriculture Hall (headquarters of the National Farmers' Union) near Hyde Park Corner, and will include two papers proposed by ourselves—the authors being Mr. C. J. Regan and Dr. W. C. Turner—and two proposed by the Meteorological Society. The two Presidents will occupy the chair, one during the first part of the meeting, and the other, after a tea interval, during the second part. The meeting should be of considerable interest and is to be welcomed, and to discuss the common ground that obviously exists between meteorology and clean air, which Sir Graham Sutton so well brought out in his Des Voeux Lecture, will be valuable to both Societies.

The problems arising because of the increasing use of small coal being produced include problems of utilization that may be of direct concern to the clean air movement, especially in the domestic field and in relation to grit and dust emission from industrial plant. The subject is to be thoroughly discussed at a special conference of the Institute of Fuel on " The Use of Small Coal Today and Tomorrow," in London on 5th and 6th May next. It will be of interest to many of our readers, and details can be obtained from the Institute at 18 Devonshire Street, London, W.1.

In the next issue of this journal full details will be given of the Society's annual conference, to be held at Llandudno on 1st to 3rd October next. The Clean Air Act, largely from the operational point of view, will again be the main theme. Readers will be particularly interested to learn that the Des Voeux Memorial Lecture will be given by Sir William Holford, Professor of Town Planning, University of London.

Freeman

His many friends in the Society and on its Executive Council will join us in congratulating Alderman John Chapman, of Newcastle upon Tyne, on receiving the honorary freedom of the city in recognition of his 45 years of public service.

Air?

Now that the word smoke has gone from the title of the Society in favour of a more comprehensive name it has been suggested that this journal should follow suit. *Smokeless Air* still has much to commend it, including its echo of Wordsworth's sonnet and the goodwill the name has acquired during its life of nearly thirty years. Nevertheless, like the old name of the Society, it may be too restricted.

As has been pointed out before, there are difficulties in using *Clean Air*, and anyhow it seems a little redundant and obvious to use this for the journal of the Society for Clean Air. One suggestion we have had, and which we would like but for the fact that it would puzzle the uninitiated, is *The New Fumifugium*. Another suggestion, which by its sheer simplicity has much to commend it, is simply *Air*.

It would be helpful to hear from readers whether they think a change is desirable, and if so to what.

Bosky Bus Story

Complaints about fumes from buses in Philadelphia are reported to have diminished when, experimentally, the exhaust gases were perfumed to give them a " fresh woodsy smell."

THE SECOND APPOINTED DAY

Statement by the Ministry

THE Cean Air Act 1956 (Appointed Day) Order, 1958, was laid before Parliament on 6th February. It appoints 1st June, 1958, as the day on which the remaining provisions of the Act shall come into force in England and Wales. (This Order does not apply to Scotland.) The sections concerned include some of the most important in the Act, especially to industry, and are as follows:

Section 1. Prohibition of dark smoke from chimneys.
2. Temporary defence and exemption from section one.
5. Requirement that grit and dust from furnaces shall be minimized.
6. Requirement that new furnaces shall be fitted with plant to arrest grit and dust.
7. Measurement of grit and dust emitted from furnaces.
8. Information about furnaces and fuel consumed.
9. Grit and dust from outdoor furnaces, etc.
16. Abatement of smoke nuisances (*i.e.*, other than smoke from a private dwelling or dark smoke).
19. Railway engines.
20. Vessels.
22. Crown premises (as applied to the above sections).
23. Repeals and transitional provisions (as applied to the above sections).

The Order (S.I.No.167) is published by H.M.S.O. at 2d. net, and may be obtained from them or from the Society (by post, 4d.).

In a circular to local authorities from the Ministry of Housing and Local Government it is said that the Minister will shortly be making regulations under section 1(2) of the Section to prescribe the permitted limits for emissions of dark smoke; and also an Order to extend the lists of works and gases controlled under the Alkali Etc. Works Regulation Act, 1906 (see Section 17 of the Clean Air Act). It is proposed that both should also take effect on 1st June next. No reference is made, in the circular, to the making of regulations under Section 7, concerning the control of grit and dust emission from pulverized fuel furnaces and those burning more than one ton of fuel per hour.

This information has been issued in good time because " the Minister wishes local authorities, industry and the general public to have early notice of the date of operation of these new provisions, so that preparations may be made in good time to ensure that they are promptly and effectually implemented.

It is also pointed out that under Section 29 of the Act it is the duty of local authorities to enforce the provisions of the Act in its area, and the Minister hopes that Councils " will give early consideration to any additional arrangements they will need to make for the discharge of this important responsibility ".

Because of the services the N.S.C.A. is prepared to give to local authority members, and its own special concern with educational activities, it is gratifying to note that the circular emphasizes the importance of such work, stating:

"Attention is also invited to Section 25, which enables local authorities to provide publicity and information in their areas about the requirements of

the Act and other matters relating to air pollution".

Building Byelaw

We are also glad to see that the Ministry's circular also expresses the hope that local authorities in urban areas will adopt the building byelaw for use under Section 24 of the Act. The purpose of the byelaw, it is pointed out, " is to facilitate smoke abatement in future by securing that domestic appliances in buildings erected from now on are of types which can be operated without smoke. This is particularly important in places which may be declared smoke control areas later on. The Act already provides that no grant is payable for the conversion of fireplaces in smoke control areas in the case of dwellings erected after 5th July, 1956, and the byelaw would help to ensure that conversion is unnecessary in such cases."

Concessionary Coal

The difficult—and somewhat delicate—question of smoke control in areas where miners receive concessionary coal as a long-standing part of their remuneration has been under active consideration recently in a number of districts, and has also been considered by the Technical Committee and the Council of the N.S.C.A. An acceptable solution to the question does not seem easy, and a reference to representations that have been made to the Minister about it is mentioned in the circular, which goes on to say: " The National Coal Board, who have been consulted, state that while they are reluctant to be committed to supply smokeless fuel for miners in smoke control areas, they are prepared to buy back concessionary coal from any miner whose house is included in a smoke control area, and that they will extend their existing buy-back arrangements to meet these cases."

We have no definite information on the extent to which arrangement for the buy-back of the whole of the concessionary allowance (none of which could be used in a smoke control area) have been agreed in prospective smoke control areas, or whether any plans for such areas are being held up because of a lack of agreement. It is, however, hoped to obtain and publish such information in our next issue.

Prior Approval

Appendix I of the Memorandum on Miscellaneous Provisions of the Clean Air Act, published for the Ministry last year, was a series of notes on principles to be followed by local authorities in considering the approval of new furnaces submitted to them under Section 3 of the Act. Suggestions for the revision of these notes were submitted to the Ministry by the Society and other bodies, and a revised form of Appendix I is included in the circular. This should be used in place of the original.

Because of their value for reference purposes the notes are being reproduced in full in the Society's *Clean Air Year Book, 1958.*

Take Your Choice

June 1st will see the introduction of the Clean Air Act. From that date, if you pollute the air by allowing dark smoke to come from your mill or factory or office chimney, you will be liable to a fine of up to £10.

If you want to dodge that fine there are two courses open to you: either to employ a solicitor with average skill who can easily claim one of the many permitted defences on your behalf; or buy yourself a Ringelmann Chart.—From *Timber and Plywood.*

A Plea for Hurry

Mr. F. Rostron, president of the Manchester Chamber of Commerce hits the nail right on the head when he says everyone should not merely support local authorities in declaring smoke control areas, but should hurry them along.

The Clean Air Act is waiting to be used. It is in the interests of every one of us to see that it does its job as soon as possible—" this year would not be too soon if it could be done," urges Mr. Rostron.—Leader in the *Manchester Evening Chronicle.*

THE SCHEDULED PROCESSES

Results of the Public Inquiry

THE Minister of Housing and Local Government has announced his decisions on the applications made at the Public Inquiry (reported in *Smokeless Air*, Autumn, 1957) on works, etc., to be scheduled under the Alkali Etc. Works Regulation Act. Any works so scheduled will, under Section 17 of the Clean Air Act be controlled for the purposes of that Act by the Alkali Inspectorate instead of by the local authorities. As reported, representations for inclusion in the schedule were made on behalf of virtually all industrial works and processes, other than steam raising.

The statement issued by the Ministry, after reviewing the recommendations of the Beaver Committee on the question of the "special cases", summarizes the proceedings of the Inquiry, and then gives the Minister's views, which may be quoted at length:

"In coming to a decision in the matter, he has accepted in principle the recommendation of the Committee on Air Pollution, on which the industries concerned primarily relied, that those industrial processes which present special technical difficulties in regard to the prevention of pollution by smoke, grit and dust, require the attention of a single Inspectorate with special technical qualifications, and should therefore be scheduled under the Alkali Act. At the same time the Minister recognizes that the main responsibility for reducing air pollution rightly rests with the local authorities and their staffs, who are on the spot and are familiar with local conditions. He accepts that there should be no unjustified diminution in their powers to control air pollution, and he has, therefore, proceeded on the basis that the extension of the Alkali Act should be strictly limited to those processes which, in fact, present special difficulties in this matter.

"The Minister has accordingly considered, in the case of each of the industries represented at the Inquiry, the nature of the particular process carried on, the nature and extent of the pollution it causes, and what practicable means, if any, there are for abating it. He has also considered how far it would be feasible for the industry to comply with the requirements of the Clean Air Act, 1956 and the Public Health Acts, and whether more effective control of pollution would be secured under the Alkali Act. In this connection he has taken into account the defences available under Section 1 of the Clean Air Act in the case of emissions of dark smoke, the Regulations to be made under Section 1(2), and the period which is allowed for necessary improvements to plant under Section 2. Likewise, he has taken into account the protection offered by Section 109 of the Public Health Act, 1936, in the case of emissions subject to the nuisance provisions of that Act."

The Works to be Scheduled

The Order relating to the schedule has not yet been laid before Parliament, and in the published list of works it is emphasized that the references "are to be used as references to the operations to be specified in the Order and not necessarily to the whole of the premises in which they are carried on".

We print the list as it is published:

Iron Works, that is to say, works in which iron or ferro-alloys are produced in a blast furnace, and in which the raw materials for use in blast furnaces are handled and prepared; and works in which iron or steel is melted or refined in air or rotary furnaces fired by coal or oil, or in cupolas employing a heated air blast; and works in which oxygen or air

enriched with oxygen is used for the refining of iron.

Steel Works, that is to say, works in which steel is made, melted or refined in Bessemer, tropaenas, open hearth, electric arc or rotary furnaces; and works in which oxygen or air enriched with oxygen is used for the refining, shaping or finishing of steel.

Copper Works, that is to say, works in which molten copper or copper alloy is de-oxygenated by the immersion therein of wood; and works in which copper or copper alloy is melted and cast in moulds the internal surfaces of which have been coated with grease-bound or oil-bound dressings.

Aluminium works, that is to say: (a) works in which aluminium swarf is degreased by the application of heat; (b) works in which aluminium scrap is refined; and (c) works in which aluminium is recovered from slag.

Power Stations—(a) works in which solid or liquid fuel is burned to raise steam for the generation of electricity for distribution to the general public or for purposes of transport; (b) works in which more than 500 tons a day of solid or liquid fuel are normally burned to produce steam for the generation of electricity for industrial purposes.

Gas and Coke works, that is to say: (a) works (not being producer gas works) in which coal, oil or other carbonaceous material is handled and prepared for carbonization or gasification and in which these materials are subsequently carbonized or gasified; (b) works in which coke or semi-coke is produced and quenched, cut, crushed or graded; and (c) works (not being producer gas works) in which gas produced by the carbonization or gasification of coal, oil or other carbonaceous material is subjected to purification processes.

Producer gas works, that is to say, works in which producer gas is made from coal and in which raw producer gas is transmitted or used.

Ceramic works, that is to say, works in which pottery products (including domestic earthenware and china, sanitary earthenware, electrical porcelain, glazed tiles and teapots) are made in intermittent kilns fired by coal or oil and in which raw materials used for the manufacture of pottery products are handled and prepared; and works in which heavy clay or refractory goods are fired by coal or oil in intermittent kilns or in continuous grate fired kilns or in any kiln in which a reducing atmosphere is essential.

Lime works, that is to say, works in which the carbonates of calcium or of magnesium are burned through the agency of coal.

Sulphate reduction works, that is to say, works in which metallic sulphates are reduced to the corresponding sulphides by heating with carbonaceous matter.

Caustic soda works, that is to say, works in which either concentrated solutions of caustic soda or fused caustic soda are produced in vessels heated by coal.

Chemical incineration works, that is to say, works for the destruction by burning of wastes produced in the course of organic chemical reactions which occur during the manufacture of basic materials for the fabrication of plastics and fibres.

The Minister has also decided to add to the list of noxious and offensive gases in Section 27 of the Alkali Act the following: fumes containing aluminium or its compounds, chlorine or its compounds, or iron or its compounds; acetylene; and the compounds of ammonia.

A number of works and processes on which representations for scheduling were made at the Inquiry have not been included. In particular there are the railways—the application was for all railway undertakings, to be scheduled, " but in particular the principal railway workshops ". Certain processes in the iron and steel industry, including the handling, treatment and disposal of slag, the melting and treatment of iron and steel to produce castings, and processes for malleabizing iron castings,

are omitted. Copper and aluminium works are restricted to the processes specified, while processes for the recovery of metals from scrap cable, by burning the insulation, are also omitted.

NEWS

We Live and Learn

The Smoke Abatement Bill, which becomes law on June 1st, could easily bring the whole of British Railways steam trains to a halt for lack of steam.

To maintain steam pressure you must have perfect combustion, which sends off puffs of black smoke.—From a letter in the *Birmingham Evening Despatch*.

Oil Firing in a Steel Mill

Messrs. Spear & Jackson Ltd., Sheffield, recently carried out an extensive conversion programme, and furnaces, previously coal-fired in rolling mill, forge, and heat-treatment departments, now use oil or gas as fuel. The lighting-up ceremony was performed by Dr. Charles Sykes, F.R.S., deputy chairman and managing director of Thos. Firth & John Brown Ltd., and he was accompanied by Prof. M. W. Thring, Professor of Fuel Technology and Chemical Engineering at Sheffield University.

The company's latest installation has been specially designed to give a controlled heat input with a temperature range of 750°C. to 1,300°C. for heating slabs and "cheeses," as circular saw slabs are known in the trade. Spear & Jackson claim to be the first firm in the country to melt high-speed steels in electric arc furnaces. That took place in 1915, and now the firm believes it is the British pioneer in using oil firing for heating slabs and cheeses.

Atmosphere control coupled with automatic temperature regulation and fuel economy are achieved by the use of self-proportioning oil burners, and additional economies are secured by employing exhaust gases from high-temperature chambers on either side of the furnace. The design of the furnace also permits its use for heat treatment purposes.

Measuring Diesel Smoke

Among interesting items of equipment to be exhibited at the International Motor Show in Geneva is an exhaust "smoke-meter" designed to measure the smoke density of diesel engine and exhaust gases.

It consists of a light source and a photo-electric cell mounted at each end of a swinging arm; there are two tubes 18 inches long, one of which contains clean air supplied under a slight pressure by an electric blower, and the other which contains a continuously supplied sample of gas from the vehicle's exhaust.

The light source and photo-electric cell can be moved together so that the path of light to the cell passes either through the tube containing the exhaust sample, or through the tube containing clean air. Output from the photo-electric cell is connected to an instrument which is calibrated to indicate smoke density. The air tube is dimensionally identical with the smoke tube and acts as a datum for use during testing.

It is stated that condensation in the smoke tube is avoided as the tube is kept at a temperature higher than the exhaust dew-point, while deposition of carbon on the bulb and photo-electric cell glass is prevented by a protective screen of clean air which passes over them.

Christmas Tree Burnings Barred

The New York City Department of Air Pollution Control warned citizens that it would hate to spoil the aftermath of Christmas with a summons, but would be compelled to do so if residents burned Christmas trees in open fires or furnaces because that would contribute to air pollution. The department advised that trees be put out for collection by the Department of Sanitation.

NEWS FROM LOCAL AUTHORITIES

Audenshaw

The Council has earmarked a district which will be a pilot scheme in the broader Manchester plan, and which has been informally submitted to the Ministry.

Bath

On 1st February, 1958 a new byelaw came into force, governing the installation of appliances suitable for smokeless fuel in new dwellings.

Bermondsey

The London Bridge area is likely to become a smoke control area on 1st October next. Council officials say that cost of converting fireplaces in the area would be only £112 10s., of which 40 per cent. would be covered by the Government grant.

The district, bounded by the Thames on the north side, is between Morgans Lane, part of Tooley Street and Bermondsey Street, St. Thomas's Street and the Bermondsey borough boundary between Borough High Street and the river. The acreage of the area is 34, and the number of dwellings 214.

Beverley

The Borough Council have been recommended by the Health Committee to agree in principle to the establishment of smoke control areas until the borough is completely smoke free.

Birmingham

The two new smoke control areas at the City Centre and Erdington have been approved in principle by the Ministry. The zone west of the City Centre is bounded by Baskerville Place, Broad Street, Bridge Street, Holliday Street, Granville Street, Sheepcote Street, St. Vincent Street, King Edward's Road and Cambridge Street.

The second new area comprises Station Road, the London Midland Regional railway line to the City boundary, Chester Road, Sutton Road, High Street, to Station Road, Erdington.

Blaby

The Council is adopting the byelaw governing the installation of appliances suitable for smokeless fuel in new dwellings.

Bolton

Bolton's new smoke control area, an extension of the town centre zone, has been confirmed by the Minister of Housing and Local Government. The area is 58 acres and contains a total of 320 premises.

A second area, which has been informally submitted to the Ministry, consists of a new housing estate of two acres and containing 81 dwellings.

Bristol

Bristol is to adopt the byelaw governing the installation of smokeless fuel appliances in new dwellings. This was agreed by the City Council at a meeting on 14th January 1958. An investigation is being made into the possibility of establishing smoke control areas in the central part of the city.

Coventry

The Health Committee are seeking approval to create two more smoke control areas in the City. The areas will cover the Municipal Tile Hill North and South estates, with an acreage of 280, and 2,400 dwellings, and the private Allesley Park Estate, acreage 135, houses 1,120.

Derby

On 5th February 1958 the Town Council approved a scheme which will make the new Priory Estate at Breadsall a smokeless zone by tenancy agreement.

Droylsden

The Council has earmarked a district

which will be a pilot smoke control area in the broader Manchester plan.

Dumbarton

Dumbarton Town Council at the monthly meeting on 29th January 1958, made their first smoke control area under the Clean Air Act. The Order, which it is hoped will come into effect on 1st November 1958, deals with an area of 625 acres lying to the north and east of the main Glasgow-Inverness trunk road where it runs through the Burgh. There is no industry in the area, which contains 1,030 houses, one hospital, and one residential nursery. There are a further 216 municipal houses in the area nearing completion.

Ealing

The Council have informally submitted to the Minister a proposed smoke control area covering 386 acres, and containing 1,212 premises.

Edmonton

Edmonton has informally submitted to the Minister a proposed smoke control area of 80 acres, containing 417 premises, residential and open space.

Ellesmere Port

The Borough Council are to make a section of the North Whitby Estate into a smoke control area. The area will later be extended, and the acreage is 120, containing 690 premises.

Fulham

The Fulham smoke control area is expected to come into force on 1st October 1958. It will affect over 3,700 residents and 200 occupants of factories and shops. It is expected that the scheme will cost £28,182, towards which the Government will make a grant of £11,273, leaving the council to pay £8,455, and the residents and occupiers of business premises, £8,454.

Hayes

A ten year programme to bring the whole of the Urban District under smoke control has been adopted. The estimate cost to the Council of this programme is £5,000 per annum, i.e. the product of slightly more than 1d. rate. The method of progression will bring in the outlying sparsely developed areas first, converging gradually on the industrial centre of the town. Smoke control areas already dealt with:

No. 1. 240 acres, 26 premises; Order confirmed and operative on 1st June 1958;

No. 2. 350 acres, 18 premises; Order approved in principle, to be submitted for final confirmation shortly.

No. 3. 265 acres, 48 premises; Order advertised and submitted for final confirmation.

Nos. 4 and 5. 440 acres, 165 premises and 376 acres, 111 premises respectively, have been submitted for approval in principle.

Hendon

Informal submission to the Minister of a proposed smoke control area of 640 acres and containing 638 premises has been made.

Holborn

Details have been submitted to the Minister of Housing and Local Government for the establishment of a smoke control area, bounded by the south side of High Holborn, W.C.1, the east side of Kingsway, W.C.2, and the south side of Great Queen Street, W.C.2.

Ilford

Ilford Council have agreed to join with Dagenham Council in asking the Minister of Housing and Local Government to confirm the Padnall and Marks Gate Estates as smoke control areas.

Kensington

Holland Ward, the part of Kensington between the High Street and Holland Park Avenue, with the railway on the west and the park on the east, will be the Borough's first smoke

control area.

Leicester

Informal submission to the Minister has been made for a smoke control area of a new housing estate (slum clearance area) of 27 acres and containing 762 premises.

Leamington

Two smoke control areas, totalling about 500 acres have been approved in principle. One zone is mostly land ripe for development and the other is mainly devoted to council houses.

Leeds

The establishment of five smoke control areas in various northern districts of the city is being considered by Leeds Corporation.

Liverpool

The first smoke control area, in the Town Centre, covers 109 acres and contains 1,920 dwellings. It has had final approval from the Minister.

Smoke control area No. 2 has been approved in principle by the Minister. It will include all that part of the city enclosed by James Street, Lord Street, Whitechapel, Manchester Street, Dale Street, William Brown Street, Lime Street, Ranelagh Street, Hanover Street and Canning Place. It can be regarded as the shopping centre, as compared with the commercial centre included in the first smoke control area.

Middlesbrough

A survey of the Grove Hill area has shown that of 1,741 houses, 1,257 are owned by the Council. The total cost of adaptations and replacements to council house fireplaces is estimated at £10,052.

Nuneaton

It is proposed to create a smoke control area at Attleborough. The area had been chosen because it consisted mainly of modern houses which would require the minimum amount of conversion.

Paddington

The area bounded by Edgware Road, Bayswater Road, Sussex Gardens and Westbourne Street is likely to be the first section of Paddington to become a smoke control area.

Prestwich

The Council have informally submitted to the Minister plans for a smoke control area consisting of a new housing estate of 21 acres and containing 123 dwellings.

Rochdale

Informal submission to the Minister of a smoke control area of 1,010 acres and containing 2,896 premises has been made.

Royton (Lancs.)

The Health Committee approved on 21st January 1958 a plan for setting up a first smoke control area. The district decided upon is Flake Lane housing estate. The plan has now gone to the Minister for approval.

St. Marylebone

A smoke control area of 132 acres and containing 2,862 premises has been submitted for confirmation.

St. Pancras

Informal submission of a smoke control area of 28 acres, mainly offices and a block of flats, consisting of 312 premises has been made.

Shardlow

The Rural Council agreed on 2nd January 1958 that part of Priorway Housing Estate at Borrowash should be declared a smokeless zone. The Council's estates at Harpur Avenue, Littleover, and at Spondon, have already been declared smokeless zones.

Shipley

The Public Health and Housing Committee has made a sample survey of 100 houses in a local district. The survey showed that of 240 fireplaces regularly in use, 103 would need no alteration and 137 would need smoke-

less fuel appliances. The cost of adaptations was estimated at £1,400 so that on this basis the total cost for the 900 houses in the area would be about £13,000.

The Committee decided to recommend the Council to approve in principle the zoning of Saltaire, Hirst Wood, and the land between Hirst Wood and Bingley Road as a smoke control area.

Shoreditch

A proposal to make an area of Shoreditch a smoke control area was considered by the Council. The Medical Officer of Health stated in a report that the area selected was the Colville Estate, bounded on the north by the Regents Canal, on the south by Hyde Road, and on the east by Whitmore Road (roughly a square mile). The area consists mainly of council dwellings, which have already installed suitable approved appliances capable of burning smokeless fuel. The Medical Officer of Health stated that it was unlikely that the smoke control area would be brought into effect before the Spring of 1959.

The Colville Estate area comprises a total of 326 buildings consisting of 311 private dwellings (308 council owned flats and 3 privately owned dwellings), 13 commercial buildings and two industrial buildings. As the Council-owned property already has approved appliances the cost of conversion will probably not exceed £100.

Stockport

The Town Centre smoke control area was approved by the Town Council at its meeting on 4th February 1958; it will be 73 acres in extent.

Sunderland

The Health Committee has approved in principle a scheme to declare 80 acres in the town centre a smoke control area. The proposed area is bounded by High Street, West Norfolk Street and Toward Road, and Crowtree Road, Park Lane and the western perimeter of West Park.

Wakefield

The City's first smoke control area was introduced at a meeting last October. The area will cover 14 acres and is subject to the approval of the Minister.

Wallasey

The Council had before it at its January meeting a preliminary report prepared by the health department and a suggestion that a beginning be made with a pilot smoke control area covering 125 acres in Moreton. The report sets out the total cost of making the whole of the town into a smoke control area, and puts forward the idea of a twenty-year clean air development plan. The net expenditure by the Council to achieve this would be £7,800 per annum. The estimated total cost of the proposed pilot scheme at Moreton would be £9,280. The Moreton area is bounded by Reeds Lane, Hoylake Road, Orchard Road, and Pasture Road and contains 1,035 houses of which more than half are post-war council houses and most of the remainder pre-war council houses.

Wallsend

The Council has provisionally selected an area for designation as a smoke control area. It is Low Willington Farm Estate, and is bounded by the Coast Road, Churchill Street, Tynemouth Road and the Wallsend-Tynemouth boundary.

Wandsworth

An area extending to the west of the Southern Region (District) railway line and to the south-east of West Hill, Kingston Road and Roehampton Vale, is to be the first smoke control area in the Borough. This decision was made by the Council on 4th February 1958.

Watford

The Council have informally submitted to the Minister plans for two smoke control areas. No. 1 is a new housing estate of 343 premises and 305 acres. No. 2 is a new housing

estate and existing residential area of 715 premises and 256 acres.

West Bromwich

The Town Centre smoke control area, which contains 25 acres and 250 dwellings, has been confirmed by the Minister.

The cost of putting this smoke control area into operation will be about £7,950. The Government's contribution will be £3,180.

Willesden

Two pilot schemes are being considered for smoke control areas in Willesden. One area is in Neasden and is bounded by parts of Neasden Lane, Tanfield Avenue, Kenwyn Drive and North Circular Road. The 50 acres site contains 616 houses and 70 shops.

The other area is in Willesden Green and affects Churchill Road (east and west sides), Balmoral Road (north-east and south-west sides), Windsor Road (east and west sides), Buxton Road (east and west sides), Osborne Road (east and west sides), Huddlestone Road (east and west sides), Lechmore Road (east and west sides), Linacre Road (west side), Chapter Road (south side-Balmoral Road to Churchill Road), Willesden High Road (north side- Churchill Road to Linacre Road.) This site contains 535 domestic properties and 44 other premises.

Wood Green

Informal submission to the Minister has been made of an area of 220 acres and containing 1,106 premises.

Letters to the Editor

How Much Sulphur Dioxide?

The Editor,
Smokeless Air.

Sir,—I would hazard a guess that the technical correspondent who supplied the data for the article " How Much Sulphur Dioxide? " which appeared in the last issue of this journal (No. 104, p. 118) belongs to the oil industry, and that his approach is a subtle attempt to suggest that the use of even high-sulphur oil, for central heating, gives less emission of sulphur dioxide than does coke. The approach is misleading and depends on the assumptions made for the thermal efficiency of use and the sulphur content of the fuels considered. The correspondent assumes a 70 per cent. thermal efficiency for all oil fuels (as well as for town gas) but only 60 per cent. for coal and coke, and manages to find a lower SO_2 emission (lb.) per useful therm by putting the sulphur content of coke at 2 per cent., compared with 3·5 per cent. for the oil of highest sulphur content.

In fact, the mean sulphur content of the oven coke produced in the U.K. in the third quarter of 1957 was 1·15 per cent., dry basis, and the outstanding value of coke as a fuel for central heating is that high thermal efficiencies can be obtained for both small and large boilers. There is thus no need to depart from the 70 per cent. efficiency attributed to the use of oil, and emission of sulphur dioxide will then be proportional to the sulphur content of the fuels. Since it is the heavy, high-sulphur oils which are chiefly used for central heating, it is inevitable that the emission of sulphur dioxide will be greater than when using coke.

Yours, etc.,

R. A. MOTT

Midland Coke Research Station,
Sheffield.

(The technical correspondent referred to states that his sole object in submitting a basis for comparison was an attempt to remove bias and introduce a rational method of evaluating sulphur dioxide emission arising from the use of various types of fuel. It was not his intention, he says, " to imply that heavy sulphur bearing fuel oils should be used for central heating, and in fact on a numerical basis probably 90 per cent. or more of such

boilers installed in this country are so small that a kerosene or gas oil grade of liquid oil would normally be recommended."

He continues: "Some element of doubt must prevail regarding the validity of the average sulphur content of coke quoted by Mr. Mott. As less than 10 per cent. of the U.K. coke production is used for domestic heating purposes, it may well be that domestic consumer deliveries can, and often do, exceed 1·15 per cent. sulphur content. There also seems to be a trend to assess sulphur contents of the various fuels simply on a weight basis without any consideration whatsoever of calorific values; obviously any evaluation must be related to the calorific value of the fuel and the most appropriate means is to employ some standard form of yardstick, for example a therm. Regarding boiler efficiencies, field tests as opposed to laboratory trials reveal that there is a difference in performance that is in favour of gaseous and liquid fuels."

Our own view is that any generalized thermal efficiency figure is likely to be open to challenge, and as far as comparison between coke and oil is concerned it might be better to disregard it. On the other hand it does seem to be correct to calculate the sulphur emission from a fuel in terms of sulphur emitted per useful therm rather than in terms of sulphur percentage by weight. Another factor, likely to favour the solid fuels, not brought out in this correspondence, is that allowance should be made for the sulphur that is not in fact emitted but is retained in the ash.—*Editor*.)

Bonfires in Kensington

The Editor,
Smokeless Air.

Sir,—The worst smoke nuisance known to me is that caused by the Ministry of Works burning dead leaves in Kensington Gardens. For the last three months in every year vast clouds of smoke pour from the enclosure by the Peter Pan statue, poisoning the air for miles around and, while such a thing might be supposed impossible even from a Government Department, on the day of dense fog that the railway smash happened, appeals for help in abating smoke were streaming out of the radio while five fires in the enclosure were aggravating matters by vomiting their pollution into the impested atmosphere.

I have been on at the M.o.W. for some years about this with no result whatever; it is like fighting a jelly-fish and all the tricks of Civil-Servicemanship are brought out in turn to deflect the question. I have pointed out again and again that if it is easy for the Borough Councils to dispose of their dead leaves without spreading despondency, it should not be beyond the capacity of the unlimited resources of the M.o.W. Recently the Ministry of Housing and Local Government came out with a thundering manifesto against polluters; on my asking why the M.o.W. was allowed to get away with what would rightly fetch down a summons on a private individual, I was met with the usual faceless gestures of bureaucracy.

Yours, etc.,

J. M. SINCLAIR

London, W.2.

Russian Approach to Air Pollution—*concluded*

U.S.S.R. the main emphasis is on the avoidance of pollution rather than on its prevention, but according to the Sanitary Code no new plant may be planned without being equipped with installations designed to purify atmospheric emissions. Neither can any plant be set in operation without a permit from the State Sanitary Control. A study of the air in the populated centre near the new plant may be made to determine whether the purification of the emitted gases is adequate, and it is desirable to make a survey of the population near the plant to make sure whether the emissions cause any inconvenience.

The Russian Approach to Air Pollution Control

This note is based on a critical review, from the U.S.A., of two books published in the U.S.S.R. It is therefore some distance from the original works, which as far as we know are not available in English. They are *Sanitary Safeguard of Atmospheric Air* and *Maximum Allowable Concentration of Air Pollutants*, both by Professor V. A. Riazanov. The review, presented as a paper to the 50th annual meeting of the Air Pollution Control Association at St. Louis in June last, and printed in the *Journal* of the Association (November, 1957) is by George Tipikin of the City of New York Department of Air Pollution Control.

The main points of interest in the two books, as discussed by Mr. Tipikin, include an attempt to approach the essential problem of the hygiene of the atmosphere from the viewpoint of Pavlov's physiology. The studies of central nervous system activity by I. P. Pavlov are currently popular in the field of Soviet Hygiene. It is said, though, that no satisfactory answer has yet been found to the essential question: how can the defence reactions of the organism to the action of harmful substances be evaluated?

This leads to discussion on the establishment of the maximum allowable concentrations of air pollution, based in part on the olfactory and irritating reaction of persons tested, and in part on laboratory tests to determine the threshold of such reactions. This introduces the questions of habitation and adaptability to adverse reactions and to indirect effects that may also affect health—such as the reduction of visibility and ultra-violet radiation. From such studies the maximum allowable concentration may be laid down as a norm, or limit, and the objective should be the attainment of that limit, even though in practice the goal may not be reached. The physiological and technical aspects are discussed at some length by Mr. Tipikin.

The further principle considered is that of zoning, not in the sense in which we refer to smokeless zones, but as restricted zones (*zony razryva*), with which urban areas are divided into residential and industrial districts, " and establishing an adequately wide restricted area between them whereby the industrial district should be located at the leeside of the housing district."

These zones are established in the U.S.S.R. according to the *Sanitary Norms for Planning Industrial Enterprises*, approved by the Council of Ministers in 1951. According to these regulations the restricted zones are established in each specific case according to the nature of the enterprise. All enterprises are divided into five grades depending on the degree of harmfulness of their emissions. The most harmful enterprises are given a restricted zone of 1,000 metres; the least harmful, 50 metres. Where no ash collecting installations are available or the cleaning efficiency is less than 50 per cent., the restricted zone may be expanded by the All-Union State Sanitary Control, but not more than twice. For heat and power generating plant in populated areas the restricted zone is established individually.

Boiler plant for heating purposes in the vicinity of housing areas with a capacity of 3 tons per hour (coal or peat) should be separated from the houses by a zone of vegetation at least 50 metres wide. The height of the chimneys of such plants should be 10 metres higher than the tallest building within a radius of 100 metres.

Such regulations suggest that in the

(*Concluded on page 174*)

Windscale—and After

THE Windscale atomic pile accident in October last was followed by a prompt and searching inquiry, on which three official reports have now been published. The first is that on the accident itself, *Accident at Windscale No.* 1 *Pile on* 10*th October*, 1957 (Cmd. 302, H.M.S.O., 1s. 3d. net). This was followed by the reports of two of the three special committees set up under the chairmanship of Sir Alexander Fleck. The first, *Report of the Committee appointed by the Prime Minister to examine the Organization of certain parts of the United Kingdom Atomic Energy Authority* (Cmd. 338, 2s. net) is concerned with general principles of organization for a large technological production group, the existing organization, and proposals for re-organization. The second, on *The Organization for Control of Health and Safety in the United Kingdom Atomic Energy Authority*, is concerned with " the organization within the Authority as a whole for control of health and safety and to make recommendations." A third report, by a Technical Evaluation Committee, has called for experimental work and calculations, and is not expected before March.

The urgency and thoroughness with which the problem revealed by Windscale was examined is reassuring. The celerity with which the reports have been completed and published is an indication of the way in which the question has been approached.

The main conclusion to be drawn from the investigation is that there is not likely to be another occurrence of the Windscale kind. The reasons for the accident are now well-known and will be guarded against in the future. It was due, basically, to a failure to appreciate certain possibilities and therefore to take the necessary steps to prevent them or to deal with them more efficiently if they did occur. To quote from the Memorandum by the Prime Minister in the report on the accident: " The Authority state that the accident was due partly to inadequacies in the instrumentation provided at Windscale for the maintenance operation that was being performed at the time of the accident, and partly to faults of judgment by the operating staff, these faults of judgment being themselves attributable to weaknesses of organization. I accept this."

The underlying importance of the inquiry is, therefore, not as an inquest on an occurrence that fortunately had no serious consequences, nor in the measures that must and will be taken to prevent any further mishap of the same nature, but rather because it has led to a new appraisal of the whole question of health and safety in the field of atomic energy. What other dangers there may be, and how and why they may arise, is difficult for the layman to know, and may in fact not be readily apparent even to the expert, especially in matters of experiment and development, but from now on they will be watched for with much greater, and more efficient, vigilance.

In other words, Windscale exposed a specific kind of hazard which it should now be easy to guard against, and has alerted all concerned against other hazards, known or (as yet) unknown. In retrospect it will probably be seen that Windscale did a great deal more good than harm.

This can be said more readily than it can, for instance, about the London smog of 1952, because of the report in Cmd. 302 of a special committee set up by the Medical Research Council to report on the health and safety aspects of the Windscale accident. The committee concluded that " it is in the highest degree unlikely that any harm has been done to the health of anyone, whether a worker in the Windscale plant or a member of the general public."

It is also reassuring to note the explicit statement in Annex V. of

Cmd. 302, that the accident which occurred at Windscale could not happen with the Calder Hall reactors or with those being built for the Electricity Authorities. The reasons for this are detailed and appear to be conclusive.

The question arises as to what extent the clean air movement, and the N.S.C.A. in particular, should concern itself with hazards from atomic energy processes. It should, it is suggested, keep a watchful eye on all developments, as far as they may give rise to air-borne radioactive materials, and should be alive to the work being done in measuring and monitoring radioactivity in the atmosphere. But there is little positive action it can take at present, unless it is prepared to become involved in the controversies concerning the world-wide menace to health from the continuing testing of atomic and hydrogen bombs and other weapons, which is infinitely more serious than anything ever likely to arise from the use of atomic energy for power purposes. Allied to this are the hazards, which have only just been ventilated, associated with the carrying of nuclear weapons in aircraft. Although an explosion may not be possible if the aircraft should crash it has been stated, in the U.S.A., that there is a risk of radioactive material being liberated and that teams to deal with such emergencies have been set up in that country.

More definitely outside the clean air sphere are the dangers of injury to health arising from the greater use of radioactive materials in industry, although this is a question of direct importance to the public health authorities.

Air Pollution in Ulster

Further steps are being taken by Belfast Corporation's Health Committee to press the Ulster Government to introduce legislation to enable local authorities to deal more adequately with air pollution.

Micro-Ringelmann Charts

The Society now has available for sale the Micro-Ringelmann Chart issued by *Power*, the well-known U.S.A. journal. These charts, 5 inches by $3\frac{3}{4}$ inches, are used by holding at arm's length and viewing the smoke under observation through a slot across the grids. The grids are a direct facsimile reproduction of the standard Ringelmann Chart as issued by the United States Bureau of Mines. Full instructions for use are given on the reverse side. The price is 2s. 6d. each, plus 2d. postage, or 27s. 6d. per dozen post-free.

Orders following the first announcement about these charts, in *Air Pollution News*, quickly exhausted the Society's original stock, but further, and larger, supplies have been obtained.

Glasgow Needs Trees

Glasgow needs between 1,000,000 and 2,000,000 trees, but first it must have a smokeless zone in which plant life could survive, said Mr. D. P. Bliss, director of the Glasgow School of Art, in an interview recently. It seemed madness to him not to make a start.

Birmingham Parks department reports that box trees in Aston Hall's Elizabeth Knot garden are " virtually impossible to maintain owing to the increasing atmospheric pollution in the neighbourhood." This is stated in the annual report of the Birmingham Civic Society, which says that considerable expense has been incurred in replanting, with different varieties of box; but the experiments have not proved successful.

Report of Chief Factory Inspector

In his Annual Report for 1956 (Cmd. 329, H.M.S.O., 9s. 6d. net), the Chief Inspector of Factories says that the Clean Air Act, where it has reduced the pollution of the atmosphere, has had immediate repercussions on standards of cleanliness and lighting.

SMOKE OVER OXFORD

A Study of Air Pollution in a University City

By

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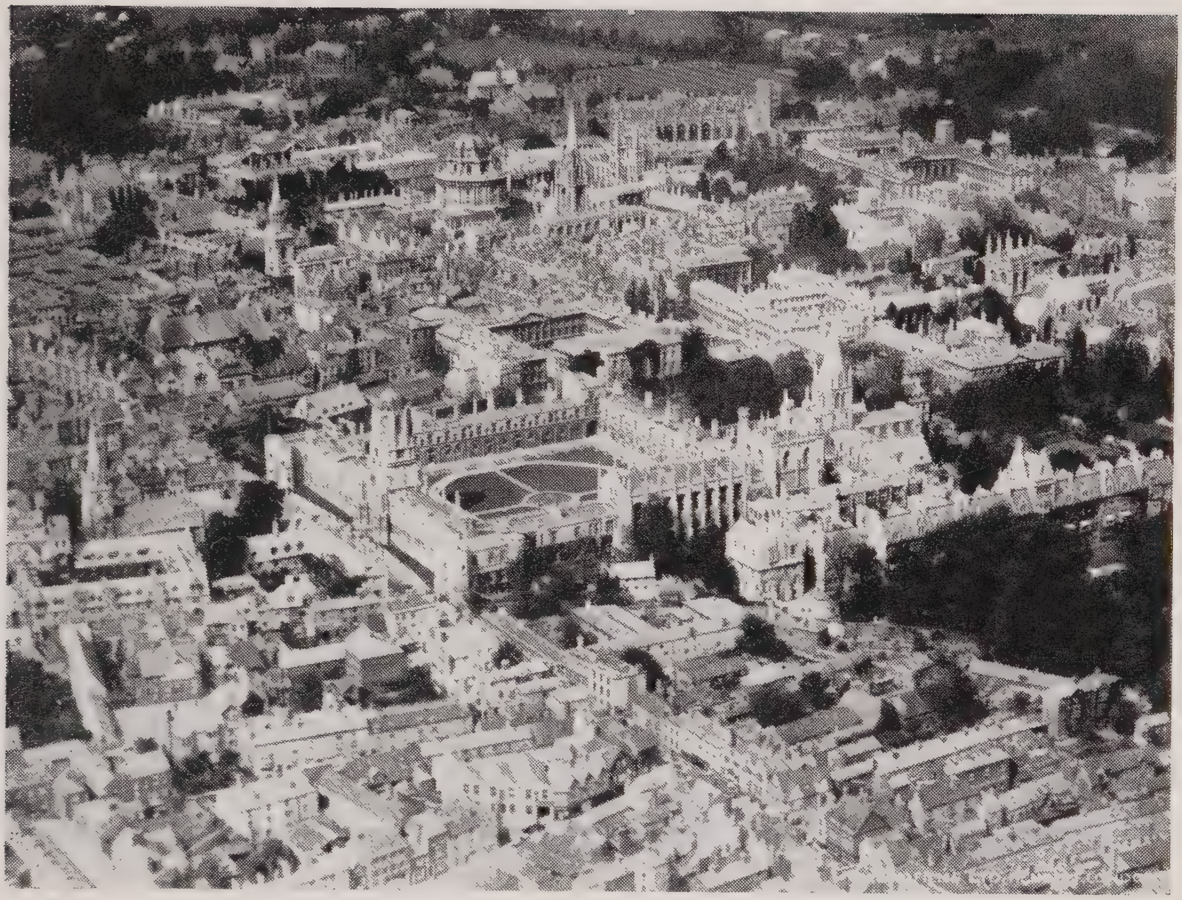
THE history of atmospheric pollution by domestic hearths and of collegiate life in Oxford are almost coincident as the foundation of the oldest colleges (University, Balliol and Merton) does not far precede the prohibition by Parliament in 1273 of the burning of coal in London. In England, however, before the widespread use of steam-power and of air-polluting processes in the nineteenth century, the problem of smoke annoyance became serious only in the largest cities. Elizabeth I was greatly grieved and annoyed with the taste and smoke of " sea-coles " in the metropolis.[1] Within a few centuries visitors from abroad, such as Nikolai Karamzin from Russia in the 1790's began to notice our love of the coal-fire and the thickening smoke-palls. He remarks on the kitchen of the Dover Inn where " coals blaze away in a huge fireplace and charm the eye with their rosy glow," and on " the perpetual smoke from the coal which floats, like clouds, over the towns and villages."[2] Yet by the time of Victoria there was much more reason why the Queen should find " the extreme weight and thickness " of the London atmosphere oppressive. The crisis in the metropolis came in December 1952 when a disastrous smog demonstrated all too clearly the need for a remedy. In Oxford a few years later a desperate appeal for more than £2 million for the repair of decayed stonework drew world-wide attention to the effect of air-pollution on limestone structures. The emphasis in the former on human health and in the latter on buildings is largely a reflexion of differences in size and function. The geographical setting of the two cities is remarkably similar.

Geographical Setting

Site. Oxford stands at the junction of the Cherwell and Thames in the gap cut by the main river through a low ridge of Corallian rocks. The wide riverine plain is liable to flood except where a shallow flight of gravel-terraces protrudes a few feet above flood-level. Most of the pre-1900 city arose on the two lowest terraces which are seldom more than 25 feet above high-water and slope gently towards the Thames. The hills to the west and east rise with moderate to steep gradients above the flood-plain. Their slopes have in recent years been much built upon. Those to westward are, as a rule, villa-studded and are rather detached from the city centre while those to the east and especially the south-east, are for the most part ribbed with streets, sometimes of terrace houses, which descend to meet the old city at Magdalen bridge.

Without quite agreeing with Belloc's description, " malarious spot," it must be admitted that the city core is naturally prone to high humidities and fog.

Against this unfortunate location can be placed the advantage of a position in a region free of appreciable



Oxford as it should be always

industrial districts from which air-pollution might drift upon the city. Nor is such an inland site liable to be much affected by chlorides picked up by winds from off the sea. In brief, air pollution at Oxford is largely of local origin. The city fouls itself and inversely could clean itself.

Climate

The general and local qualities of the climate at Oxford do little to ameliorate the problem of air pollution. This part of the Thames valley is relatively dry and the mean annual rainfall only just exceeds 25 inches. Yet rain occurs on about 173 days in a normal year. Such frequency of light rainfalls does relatively little to remove smoke *both* from the air and from buildings. Rather it facilitates, by constant dampening, the discoloration and decay of stonework.

The prevailing air-movement at Oxford is from west and south, except from February to June when north-easterly winds predominate. "Winds from east and south-east are infrequent at all seasons."[3] It will, however, be seen from the map (Fig. 1) and following Table that the wind-direction varies sufficiently to allow smoke, if present, to drift from all the suburbs on to the city core.

It will also be obvious that smoke-yielding concerns should be banned at least from quarters lying south and west of the city centre.

The concave topography in which Oxford lies has an interesting local effect on the climate. On calm clear nights the rapid chilling of air upon the adjacent hill-slopes often leads to a downward creep of cold surface air. This katabatic breeze is gentle and is much hindered by tall vegetation and

Mean Annual Wind Direction (Percentage) at Oxford, 1881–1935

N	N-E	E	S-E	S	S-W	W	N-W	Calm
10	13	6	7	14	22	15	9	4

buildings but it frequently leads to the formation of valley-fog and temperature-inversions. At Burford in Oxfordshire katabatic breezes occurred on 63 nights in 21 months[4] and there is no doubt that this downslope creep of night-air during anticyclonic weather plays an appreciable part in the formation of fog at Oxford. Whether these breezes bring smoke from outlying suburbs into the central wards is another matter as they flow slowly and the average suspended life of smoke particles is about 24 hours and of sulphur dioxide less than 12 hours. When the katabatic creep is weak it may not completely invade the close-built city core which retains a pocket or "island" of warmth throughout the night. Yet there is no reason to doubt that at least the urban areas nearest the foot of the hill-slopes are affected by smoke drifting downhill with the katabatic wind, especially when anticyclonic weather encourages the formation of fog and the accumulation of air-pollution over the city itself. Oxford experiences about 39

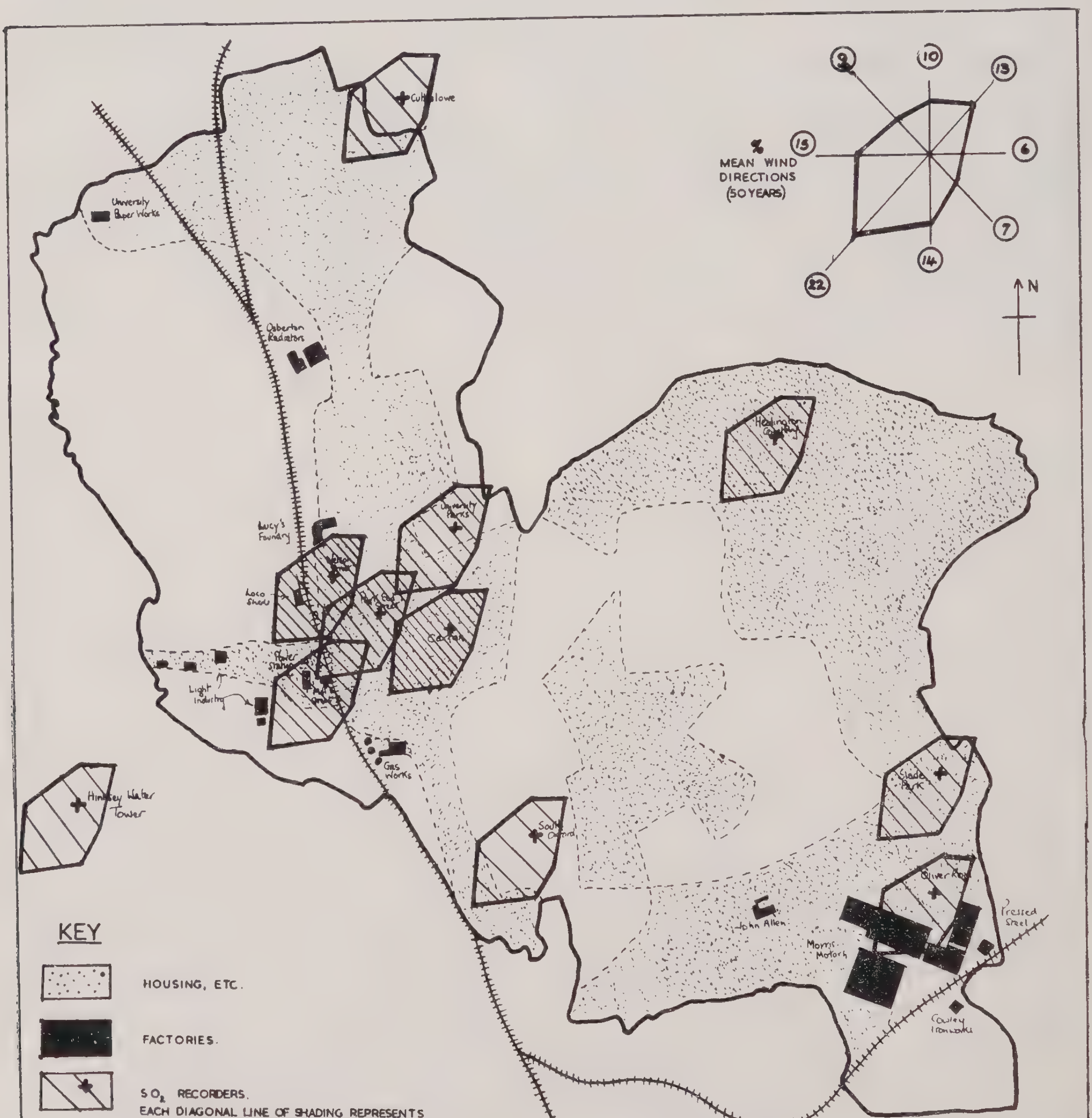


Fig. 1.

CITY OF OXFORD.

ANNUAL AVERAGES AROUND SULPHUR RECORDING STATIONS (BASED ON WIND CHART).

fogs in an average year, nearly all of which occur between late September and early April. Many of these are associated with katabatic creep and almost all are accompanied with a marked increase in air-pollution (Fig. II). Hence it is certain that smoke increases the density of the fogs and in so doing may slightly prolong them.

Conditions Creating Atmospheric Pollution

It is perhaps unnecessary to prove that sources of air pollution exist in Oxford although the high price of coal here has always militated against its extravagant consumption. The most notable changes in coal-supply came with the canal in 1790 and with the railways to the north Midlands in the 1850's. But the city remained small and its nineteenth-century expansion (from 12,000 to nearly 50,000 inhabitants) was accommodated largely on low gravel-terraces close to the old core. This earlier growth ranged in type from garden-encircled villas—now deemed palatial—to close-knit streets of terrace dwellings. The former could hardly create a serious smoke problem whereas the latter has a considerable smoke potential.

During the twentieth century, and especially since 1921, Oxford expanded at an abnormal rate particularly to the east and south-east. Between the two world wars about 10,000 houses were built in the city and its population reached nearly 100,000. Today about 120,000 live in it and the suburbs forming a direct extension of its built-up area.[5]

At the same time the fuel consumption in domestic grates has grown in like proportions and there has also arisen a large manufacturing industry. The older factories and industrial units, such as gas-works, railway station and brewery, were established mainly in or beside the west and south-west parts of the old city. Most of the newer factories arose at Cowley nearly three miles to the south-east of Carfax. Here the chief industry, the assembly of motor-cars from ready-made components, is relatively "clean." As a possible source of air pollution in the city centre it cannot be ignored, especially during strong south-easterly winds and nights with vigorous katabatic breezes, but its direct effect is mainly local as recent fulminations in the Council Chamber so vividly describe.

Hence to attribute the present air pollution in central Oxford to twentieth-century industrialism is unwarranted. The general expansion of the built-up area is a more reasonable cause, and there seems no doubt that the bulk of the smoke affecting the city centre emanates from the grates and furnaces of tightly-packed terrace streets and of industrial concerns (gas, electricity, railway, etc.) within, or within a mile or so of the city core.

It happens that in a University city the study of air pollution is complicated by the presence of college quadrangles. The typical quadrangular college is a rectangular arrangement of concentrated terrace tenements, peculiar in so far as each inhabitant needs a room with a fire. Such a concentration of hearths is remarkably smoke-yielding. The following statistics for coal-consumption excluding anthracite, at University College, relate to 1929, a year when the amounts burnt were considerably below those in pre-1914 times but had not yet been decreased by electric heating.

	cwt.
Hilary Term	2,424
Trinity Term	469
Michaelmas Term	1,816
	4,709

The total of 235 tons 9 cwts, demonstrates that this college consumed on an average well over one ton of coal for each day of full term while in cold weather the consumption exceeded 15 tons a week. A diligent student could, with the aid of the domestic account books, apply the argument to the whole of the University quarter but it seems sufficient for our purpose to demonstrate the high rate of coal consumption—often greater than that of a good-sized textile factory!—and

to point out that the quadrangular shape of colleges ensured that at least one side of the quadrangle was liable to be fouled by the smoke-barrage from the opposing façade. This self-fouling is, or was, most operative on windy and wet days with a turbulent air-movement. In addition, the sides of neighbouring colleges inevitably experienced some defacement. Today most Oxford colleges burn relatively little coal. For example, in University College the annual consumption is under 20 tons or about that of a single week in some cold spells thirty years earlier. The remedy here is almost as complete as the damage to stonework facilitated unwittingly by generations of aularians who worshipped the coal-fire.

Amount of Air Pollution

Although voluntary and official efforts have done much to curb or prevent the emission of black smoke in and near the city core, the problem of annoyance and damage from air pollution still remains. Today the total solid fuel consumption in Oxford, including carbonization and electricity production, is about 300,000 tons a year or nearly 3 tons per person. Some of the resultant pollution drifts on to the adjacent countryside but an appreciable amount, for reasons already discussed, must settle locally. The quantity is now measured by a volumetric recorder installed near the City Centre in the Office of the Chief Public Health Inspector and readings are taken daily. Weekly averages are

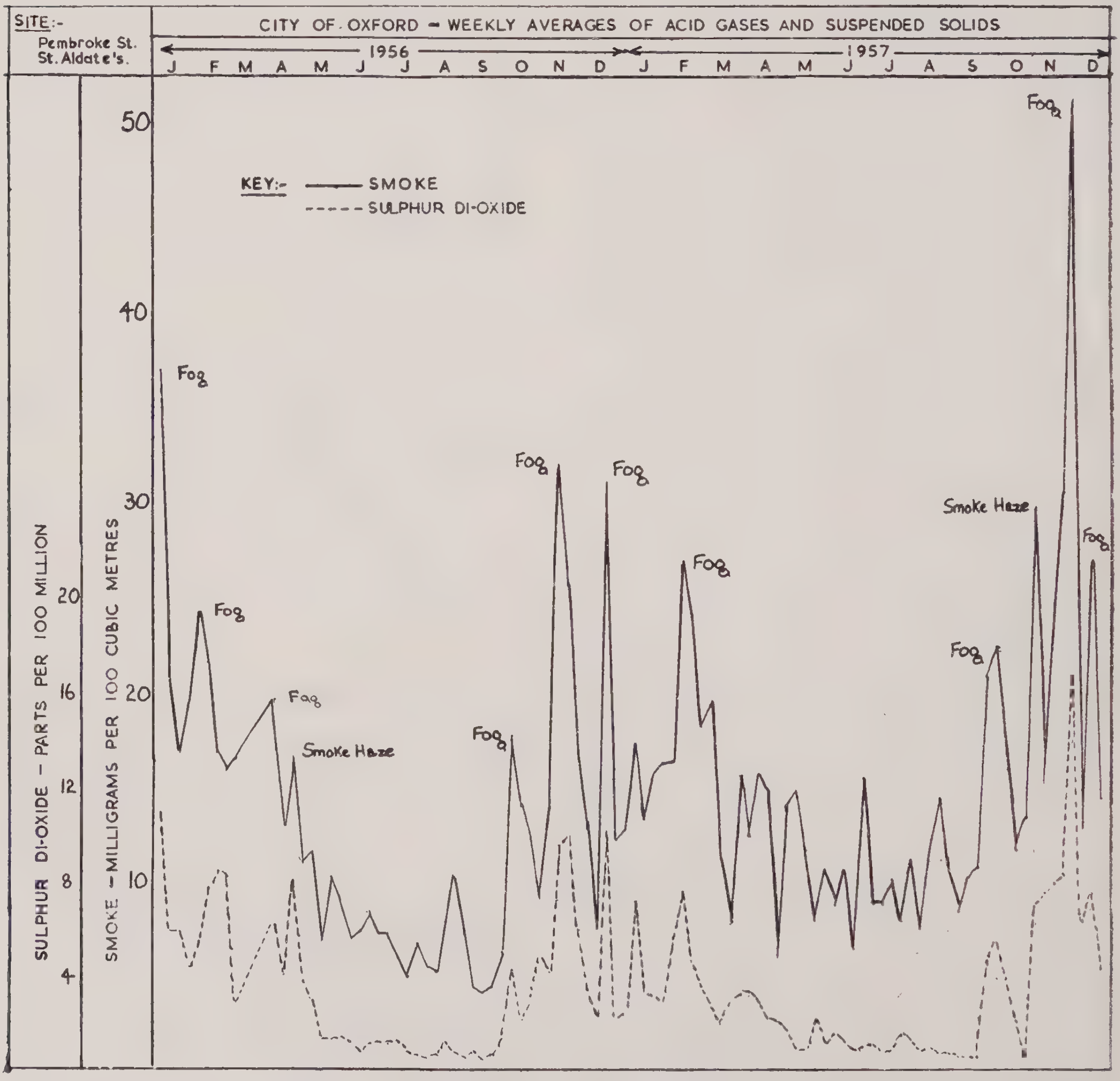


FIG. 2.

Eroded Stonework, Brasenose College

shown by graph in Fig. 2. As may be expected in conditions of fog and smoke haze[6], the readings are higher than normal and greater concentrations are evident during the winter months, October/March. The highest daily readings occurred on 2nd December, 1957, when, in conditions of persistent thick fog 98·0 mgms. of suspended solids were recorded with 30.30 p.p.100 m. SO_2. The nearest approach to these figures was on the 6th January, 1956, which showed readings of 87·3 and 28·8 respectively. This also was an occasion of persistent thick fog. The Geography School of the University has also set up a daily recorder and readings are being compared. The instrument is situated in the School which is about a half mile to the north east of the existing Health Department recorder. Sulphur dioxide has also been measured by the lead peroxide method at a number of points throughout the City since 1954 and it is interesting to compare the annual averages for the various stations concerned.

Fig. I shows a map of the City with a wind rose giving the average wind directions over some 50 years. Plotted over each recorder point is a similar wind rose of approximately a quarter mile radius and hatched to show average annual readings. It will be noted that the heaviest concentrations are in and near the City Centre. It is already interesting to note that after slight rises of sulphur[7] averages over most stations in the years 1954 to 1955 a decrease is now evident and all stations show a decline throughout 1957.[9] It is of particular significance that the recorder in the City Centre (Telephone House) shows a progressive decline over 4 years, i.e. readings 2·2, 2·12, 1·97 and 1·80. This is an encouraging sign following Clean Air publicity.

Problems of Preservation of Stonework

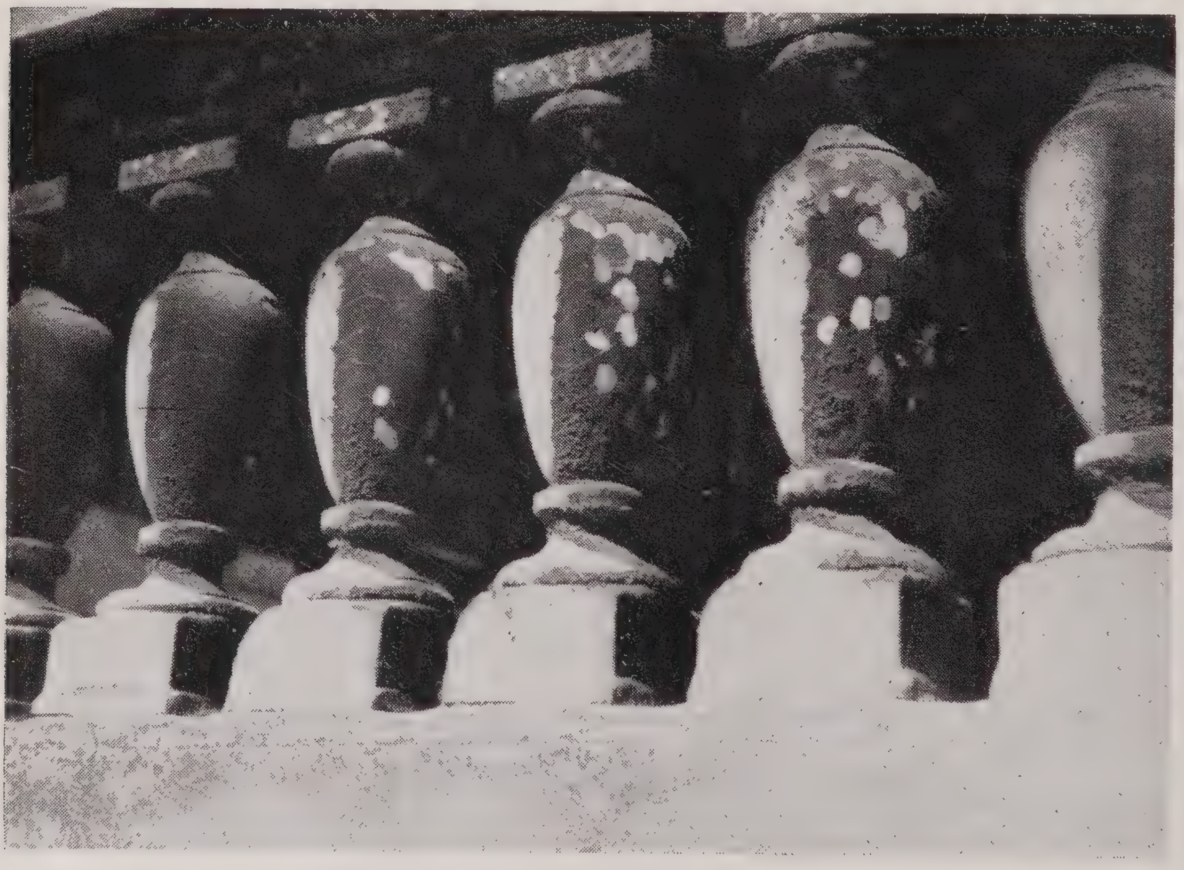
Experiments by Dr. E. J. Bowen have shown that few or none of the local limestones will long resist

weathering, especially when assisted by air pollution.

The better local limestones even when on relatively protected wall-faces, have become seriously rotten and deeply spalled after about three centuries; inferior stone, especially in well-exposed structures, such as chimneys and pinnacles, begins to crumble and flake in less than a century. Some decay would occur naturally in a " clean " atmosphere but air pollution greatly increases the rapidity of the weathering. The decay and disfigurement is also associated with surface-discoloration, some of which may be due to microbiological effects in sheltered patches.[8] But to prevent re-iteration of what the recent *Appeal* has so clearly stated, it may be pointed out that the difference between the blackened, crumbling façades of many Oxford buildings and the sun-reflecting house-fronts of Cotswold towns, such as Painswick and Chipping Campden, lies mainly in differences of air pollution.

The stone-work can be restored only by careful washing with water and replacement of decayed parts by stone such as Clipsham. To maintain the condition, palliatives of uncertain value such as painting the clean stone with transparent plastics or silicones may be used, or smokeless zones may be created; the latter is already being planned officially for Oxford and indeed has already, because of the cost of domestic labour, begun to be applied voluntarily. The official plan is on the following lines:

In the City central region five smoke control areas are proposed. These have due regard to redevelopments and improvements in so far as the gas and electricity stations and railway undertaking are concerned. A further proposal is that new Council estates such as the Blackbird Leys estate to the south east, should be declared smoke control areas from the outset. It is envisaged that over a period of 20 years progressive extension throughout the Areas 1-5 coupled with re-development of the St. Ebbe's (No. 3) area and probable removal of



Balustrade at the Ashmolean Museum

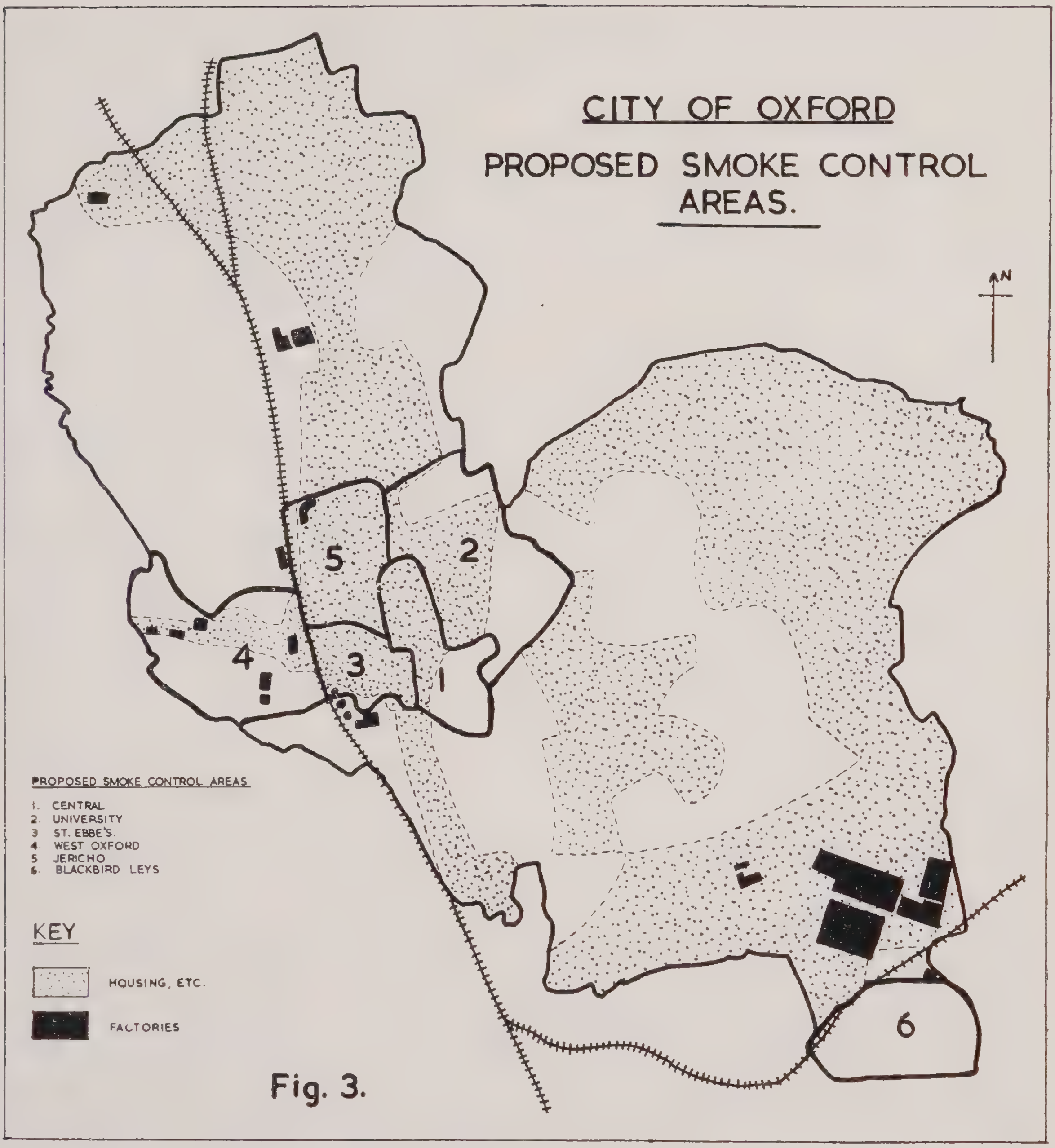


Fig. 3.

the gas works and the electricity power station would greatly reduce smoke production from the south-west and centre and as diesel operation —already imminent—on the railway to the west, is carried out, still further improvement will be secured.

Advantages to Health and Amenity

At first sight it may appear that the prime advantage of smokeless zones would be the prolongation of the life of stone masonry and paintwork in Oxford. To many this would seem a sufficient reason. But other advantages will also accrue. There will be—once the city façades are cleaned—a noticeable increase in reflected light, a new air of brightness and luminosity. There also ought to be a slight decrease in the density and duration of fog and a slight increase in the amount of sunshine, an element of which we enjoy so little that any extension would be welcome.

The effect on health should be apparent for with the removal of visible dirt and such improvement in light as may be effected over the Clean Air Zones, the public living and working therein should benefit. There is no doubt that the removal of pollutants from the air is desirable in the interests of better health and

preventive health measures of this kind must be surely worth the effort and expense. It is certain that we cannot secure improvement without expense and it is hoped that the public and all concerned will appreciate the need to pay a little more for the benefits which must surely accrue both to health and amenity.

REFERENCES

1 *National Smoke Abatement Society Year Book*, 1956.
2 Karamzin, N. M. *Letters of a Russian Traveller* 1789–1790. (Trans. by Florence Jonas). O.U.P. 1957.
3 Smith, G. C. " Climate in *The Oxford Region* " (e.d.). A. F. Martin and R. W. Steel, 1954.
4 Heywood, G. S. P. " Katabatic Winds in a Valley." *Quarterly Journal. Roy. Met. Soc.*, Jan. 1933. See *also* Kendrew, W. G. *Climatology*, 1949, p. 46.
5 Gilbert, E. W. Various articles, summarized, with reference in *The Oxford Region.*
6 Combey, W. Chief Public Health Inspector. *Section Report.* Annual Reports of Medical Officer of Health, 1954/5/6.
7 Combey, W. " *War Upon The Air* " The Sanitarian. Volume 65, No. 2. November 1956. Pages 103/120 with discussion.
8 McLachlan, T. " The Role of Sulphates in the Decay of Building Stone." *Journ. Soc. Chemical Industry, LIX.* 133–138.
9 Department of Scientific and Industrial Research. *Atmospheric Pollution Bulletins.*

10 Acknowledgements. Grateful acknowledgement of assistance is made to Professor E. J. Bowen, M.A., Department of Physical Chemistry, Oxford University, and Messrs. J. W. P. Mullard, R. Merriman and S. Noon of the City Health Department.

London P.H.I.s Discuss Clean Air

A meeting on 29th January of the London Centre of the Association of Public Health Inspectors discussed clean air, with papers by Miss M. Lovell Burgess, Lectures Officer of the Gas Council, on " The Clean Air Act," and M. G. Bennett, Superintendent, Operational Research Division, British Railways, on " Smoke by Railways." The Chair was taken by J. C. Clancy, President of the Centre, and Chief Inspector, Public Health Department, London County Council.

In the course of her address Miss Burgess said that there were encouraging allies for clean air where the changing social pattern of life was concerned.

Eight million women went out to work and nearly four million of them were married. When the wife went out to work as well as the husband there was literally no one to keep the home fires burning, whether in the grate or the domestic boiler. And that meant a change in the heating pattern.

Other coal allies included television, which had lessened the concentration on the coal fire. Instead of seeing pictures in the fire people saw them in a glimmering box, and as long as they were kept reasonably warm by some appliance there was not the focus on the fireplace that existed only a few years ago. Thousands of frustrated older people, who could not get jobbing help in the garden, or someone to clean windows, or scrub floors, were prepared to spend more money on trouble-free heating appliances. Young people, following the do-it-yourself craze, resented having their delicate contemporary decorations dimmed by smoke and smuts from a coal fire. And finally, the high price of coal meant that many people were, for the first time, looking critically at the design of their fireplaces.

Conversions of Old Fireplaces

Quite a few Public Health Inspectors, said Miss Burgess, were unfortunately tending to put the emphasis where the conversion of old fireplaces was concerned, more on certain authorized fuels than on approved appliances. Others were advocating the burning of coke in grates with wider spacing of bars, or even on ordinary stool-bottom coal grates.

" Where adaptation is concerned, let it be noted that the provision of gas ignition to the domestic grate is provided for, under the Act, as qualifying for grant. Let it also be noted that there are only three Gas Boards making special low temperature cokes, and, in many areas, it may become difficult, or even impossible, to obtain reactive cokes, whether marketed by the gas industry or by private firms. The ordinary gas coke—a very burnable fuel when used in an approved appliance—will have to bear the burden of solid fuel requirements, and for gas coke gas ignition is necessary. Let the people burn reactive cokes if they can get them, by all means, but provisions should be made for gas ignition, for the burning of gas coke."

Railway Smoke

Mr. Bennett began his paper by pointing out that in this problem of railway smoke some smoke was inevitable and the difficulty was to know what action to take to restrict it as much as possible. There had always been a clean air problem since steam railways began and even as far back as 1826 the Liverpool and Manchester Railway were forbidden to use any locomotive which could cause a smoke nuisance. Later the railways transferred to coke in order to minimize smoke. By 1860 three improvements had been invented—the brick arch, the deflector plate and the blower. These enabled sufficient air to be drawn into the firebox and sufficiently intimate mixture of the air and volatiles in the hot space over the firebed to ensure practically complete combustion. These inventions became standard design features and enabled bituminous coal to be used again.

In order to limit smoke emission, four factors were involved:

1. The engine should be well-maintained.
2. It should not be overloaded.
3. The fire should be properly prepared.
4. Skilful firemen should be employed.

The main trouble was caused when lighting up from cold when there was no draught. Firelighters and ordinary coal were used and it was essential that the coal should be put on in small quantities after the initial lighting until 50 lbs. pressure had been raised to work the blower.

Another difficult time was during long standing periods when the engine had to be fired slowly in order to burn the volatiles before they escaped. This problem arose particularly with excursion trains at popular seaside resorts on Bank Holidays when sometimes up to 100 trains had to be held in the yard in steam during the day in order to run back again in the evening. Each one of those engines would produce a little smoke but when that was multiplied 60–100 times it became very objectionable.

The remedy was not easy to find. Skill and good coal certainly helped, but the pre-war coal was cleaner and better. Large coal was generally the best coal and this was broken down on the footplate, as the best size for actual firing was roughly between three and 9 inches. Before nationalization, the separate railways bought coal to different specifications and descriptions and although it was not possible to determine exactly the proportion of different grades used, it was estimated that approximately 75 per cent. was of the quality wanted, whereas nowadays it was less than 50 per cent. In 1957 the railways were obliged to use 11 per cent. briquettes bonded with pitch and this must inevitably produce smoke.

Deterioration in coal quality caused inefficiency resulting in a decrease in the ratio of train-miles run to tons of coal burnt, and also caused more

smoke, having in mind what an enormous amount of power was required from a small grate.

Training

Skill on the footplate was essential. The traditional methods of tuition were not merely all that were relied on. Many methods of education and supervision were employed. There was the system of mutual improvement classes, operated by the men themselves, by which senior and experienced staff explained to the younger men the mechanism of locomotives and how they should be used. Educational trains toured the country, giving demonstrations and film shows. A new booklet describing the art of efficient locomotive firing had been issued to all the staff, and there were 100 or more firing instructors whose continuing function it was to help and advise the men. The occasional careless man was unavoidable but the teaching methods were revised continually and the aim was to have the men well-taught as a team and conscientious.

The design of locomotives had improved very much—they now give three times the efficiency per total horse-power per pound of coal and the steam passages had been improved and the grate areas increased, but the final answer was gradually to do away with steam locomotives altogether. This plan will take about 15 years and naturally depends on the supply of capital, but, meanwhile, although the quality of future coal supplies is uncertain there should be some improvement in the atmospheric pollution caused by steam traction for the following reasons:

1. The improved education and supervisory arrangements and the good maintenance of the engines.
2. The gradual change-over to electric and diesel engines.
3. The older and less efficient engines would be scrapped first, so that the efficiency of the remaining fleet would continually improve.

Mr. Bennett concluded by admitting that lighting up at the depots was the biggest problem. At some yards Coalite was used and low volatile Welsh steam coal, but there was not nearly enough smokeless fuel available for this purpose. Partial remedies such as roofing-over yards or sheds and ducting smoke through a chimney, or pre-steaming, had been suggested, but British Railways were already committed to a modernization programme and capital must be spent as per the programme. The railways were anxious to co-operate with clean air campaigns and all the District Locomotive Superintendents would assist in dealing with local smoke nuisances as much as they could.

Diesel Locomotives on Order

The North British Locomotive Company, Glasgow, have received a contract for 52 main line diesel-hydraulic locomotives, each of 1,000 h.p., from British Railways. The Glasgow company now have orders on their books for diesel-hydraulic locomotives valued at more than £5m.

The 52 locomotives ordered represent the first major instalment of a scheme for the complete replacement of steam by diesel traction on the whole of the Western Region lines between Newton Abbot and Penzance, including all goods and passenger services, and on many of the through trains between Paddington and Bristol and the west of England.

The total number of diesel-hydraulic locomotives required for this programme is about 130, to replace more than 200 steam locomotives.

Fourteen diesel-hydraulic locomotives for the Western Region are already under construction or on order from the North British Locomotive Company or at the British Railway workshops at Swindon.

The Central Electricity Authority ceased to exist on 1st January, 1958, and is replaced by the Electricity Council and the Central Electricity Generating Board.

Reviews

A Text Book from Sheffield

Air Pollution, edited by M. W. Thring. Butterworth's Scientific Publications, London. 42s. net.

This volume is based on the lectures given at a course on air pollution at the University of Sheffield in September, 1956. Some of the lectures have been expanded and there is one important addition. The course was directed by Professor Thring, of the Department of Fuel Technology and Chemical Engineering, who has edited the book. It has been admirably produced by the publishers and there are many illustrations in the 248 pages.

As a general text-book on air pollution it is excellent value, and can be recommended to all who need technical and scientific information on the problem either for study or reference. The quality of the contributions is generally high and authoritative.

The volume contains fifteen papers, with a foreword by Sir Hugh Beaver. The papers fall into sections—what air pollution is; its consequences; the dispersion of discharged gas; the elimination of pollution; and a final section on legislation, headed " grappling with the problem."

The first paper, by G. Nonhebel, examines the characteristics of solid and gaseous pollutants in a comprehensive way. It is followed by Dr. Wilkins on the measurement of air pollution and by W. F. B. Shaw on the measurement of smoke in chimneys.

The section on the consequences of air pollution consists of two papers: on health and vegetation by Dr. J. Pemberton, and on buildings and metalwork by R. J. Schaffer. Then comes the longest paper of all, on the geographical factors affecting air pollution, by Dr. Alice Garnett, followed by C. H. Bosanquet on the flow of chimney gases.

To many readers the section on the elimination of pollution will be of most direct value. The question of domestic smoke is dealt with in a second paper by W. F. B. Shaw, and that of vehicle exhaust fumes by Dr. A. Fitton. Then come industrial boilers, by J. W. Batey; pollutants from the iron and steel industry by Professor Thring; refractories, ceramics and cement by Dr. J. White; and finally the choice of gas cleaning plant is discussed by Dr. C. Hulse.

The final section consists of two short papers on legislation to deal with air pollution: its development and principles by Arnold Marsh, and the industrial sections of the Clean Air Act by J. W. Batey.

It will be seen from this description of the contents that the study of the problem made at the University, and now made permanent in this book, has covered the field very widely indeed. There are inevitably a few factors of importance that are missing, particularly on the economics of air pollution, while the very brief references to vegetation might have been expanded with advantage. It is unfortunately impossible to review the individual papers in the way they deserve, or to quote from them as could be done at some length.

Measurement of Air Pollution. Department of Scientific and Industrial Research. H.M. Stationery Office, London. 2s. net.

It is difficult to avoid the old cliché, for this handbook literally does fill a long-felt want. The material it contains has largely been available in the past in duplicated form from the Fuel Research Station, but it is most helpful that it should have been revised and printed as a booklet that can be purchased direct from the

Stationery Office or through any bookseller (including, of course, the N.S.C.A.).

After describing the organization of the "Investigation of Atmospheric Pollution"—its objects, the need for co-operation, the Standing Conference of Co-operating Bodies, and the Atmospheric Pollution Research Committee—the booklet describes, precisely and practically, the instruments that are used, the techniques employed, the analysis and recording of observations, and the interpretation of the results.

For anyone engaged in making air pollution observations, and particularly for those tackling such work for the first time, the booklet is indispensable. The observations described are those for the determination of deposited matter, both by the standard gauge and by petri dish rapid survey, for sulphur dioxide with the lead peroxide instrument and by the volumetric apparatus, and for smoke or suspended matter with the smoke filter.

A Study in Detail of N.I.F.E.S. 3rd Progress Survey. Combustion Engineering Association, 6 Duke Street, London, S.W.1. One guinea net.

This volume is the proceedings of the C.E.A. conference held at Harrogate in November last, to which reference was made in our last issue. The 3rd Progress Survey of N.I.F.E.S. was an important document to all concerned with fuel efficiency in industry, and the report of the conferences, which includes both papers and discussions, increases its interest by providing a critical commentary from those most directly concerned.

The conference was useful not only from a practical point of view, such as in the factual information that emerged, but also for the indications it gave of the climate of opinion that exists in the field of fuel economy, at least among those in the vanguard. The C.E.A. report is in effect an important appendix to the N.I.F.E.S. survey.

Atmospheric Pollution from Road Vehicles, by Douglas Lister, F.A.P.H.I. Association of Public Health Inspectors, 19 Grosvenor Place, London, S.W.1. 5s. post-free.

The Association has published, in duplicated form, the thesis submitted by Mr. Lister to Fellowship of the Association. We should like to congratulate both on his Fellowship and also on the high quality of the work for which it was granted to him. The thesis is in fact an important addition to the literature on air pollution from road vehicles, surveying the problem in all its aspects in a clear and systematic way, with full documentation and references. The contents fall into three main parts: the extent of the problem, its technical nature, and the solution. There are also appendices, a list of references, and a bibliography.

The ineffectiveness of present legislation to control, if not to prevent, smoke and fumes from vehicles is well brought out by the author, who makes suggestions for improving the situation that should be considered. He truly points out, in one important matter, that:

" . . . an opportunity is going to be lost in the setting up of official vehicle testing stations (where brakes, steering, lights, etc., are normally to be dealt with) if there is not to be incorporated some test for the condition of exhaust emissions. The aim is eventually to have periodical compulsory examination of all vehicles over a certain age, and all such vehicles could well be tested for smoke emission under controlled conditions simulating circumstances on the road likely to induce smoking. Objective measurement could then be used, so overcoming the difficulty of the human element in assessing smoke density, for without such accurate measurement, the permissible level of smoke must always remain a high one. In addition to the vehicles passing through the station, police officers would have the power to refer others for testing, to support their observations on the

roads, and once such a procedure became established, there is little doubt that all operators would be kept alive to the necessity for proper maintenance and operation—in other words the improvement would not be confined only to those vehicles tested."

The author's other suggestions are: (i) registration of approved stations for diesel engine maintenance, empowered to affix official seals to pumps and governors that have been adjusted; (ii) some compulsory form of de-rating for diesel units; (iii) introduction of overhead exhaust systems; and (iv) a requirement that the exhaust outlet of all commercial vehicles should at all times be visible to the driver (by the rear view mirror, or otherwise).

Our main regret about this paper is that it has not been published in the printed book form it deserves. It would then, of course, have been more expensive, but even at twice the price, or more, it would still be good value.

Clean Air For You. Solid Smokeless Fuels Federation, 74 Grosvenor Street, London, S.W.1.

This is probably the most useful pamphlet so far available on the implementation of the sections of the Clean Air Act relating to smoke control areas. It is primarily intended for the information of local authority members and officers, but will be of value also to the landlords and tenants in proposed areas. The explanatory notes are practical and to the point—on conversions, grants, and the like—and this section is followed by a description of the authorized solid smokeless fuels. Perhaps the special value of the booklet lies in the detailed, and illustrated, description of different kinds of conversion that may be called for, with actual costs likely to be involved, from the simple replacement of a stool-bottom grate to the replacement of old cast-iron fireplaces with approved independent or combination appliances. Both the cost of the appliances and the estimated cost of builder's work, surrounds, gas connections, etc., is given.

This information will help local authorities to make reasonable estimates for the cost of conversions according to the type of house they have to deal with. The booklet is attractively produced and good use is made of colour printing.

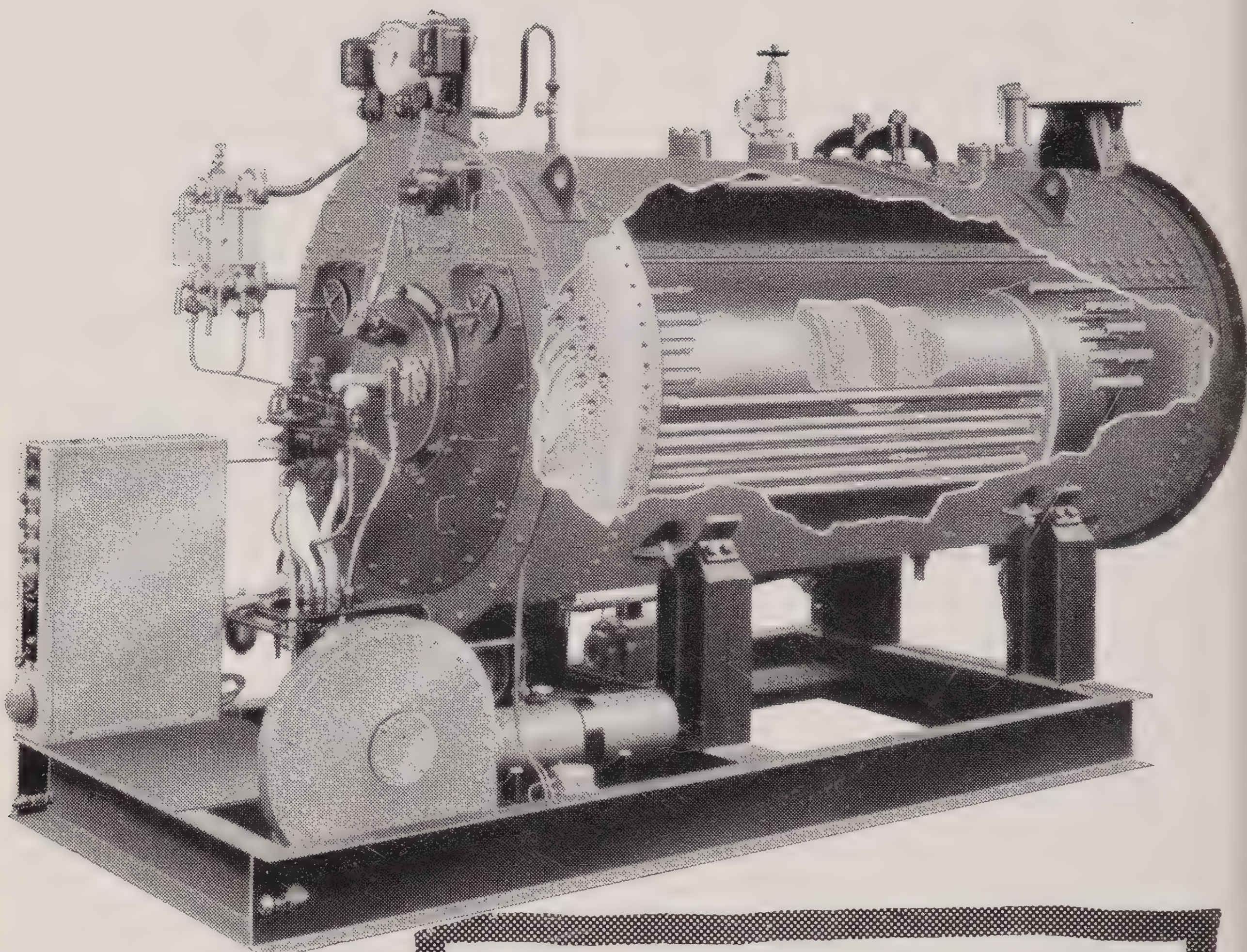
Clean Air. British Medical Association (Family Doctor publication), Tavistock Square, London, W.C.1.

This 32-page booklet is designed for the householder and is available to Medical Officers and local authorities at 2s. per dozen copies. It includes an article " Focus on Smog " by Sir Allan Daley, a detailed description of the Clean Air Act as it may concern the householder, and articles on fuels and appliances for use in smoke control areas, together with useful notes on thermal insulation and draught exclusion in the home. There are a number of illustrations of typical fires, stoves and cookers.

Annotated Bibliography on the Effects of Atmospheric Pollution on the Health of Man. The Kettering Laboratory, College of Medicine, University of Cincinnati, Ohio.

This is the most comprehensive bibliography we have yet seen on the most important aspect of air pollution. It is published in large quarto, cyclostyled, and runs to 481 pages. There are 790 items, each one with an abstract or annotation of from a few lines to several hundred words. There are also complete subject and author indices.

It is a most important contribution to the documentation of the literature and represents a very considerable amount of work in search, abstracting and indexing. The work was supported in part by a research grant from the National Institutes of Health of the U.S. Public Health Service. It is a noteworthy example of the valuable work being done in the U.S.A. with the funds that, in comparison with what is available in this country, appear to be so amply available.



European Conference on Air Pollution

W.H.O. Meeting in Milan

By Peter C. G. Isaac, B.Sc. (Eng)., S.M., M.I.C.E., F.R.S.H.*

THE first international conference on air pollution was held from the 6th to 14th November in Milan. It was organized by the European Regional Office of the World Health Organization with the co-operation of the Italian Government and of the Milan Provincial Administration. Twenty-one European nations were represented: Austria, Belgium, Bulgaria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and Yugoslavia. There were observers from the U.S.A., from the European Coal and Steel Community and from the Organization for European Economic Co-operation.

Much of the material was circulated in advance as formal papers and these, together with additional information, were introduced by the authors and discussed in full session. The conference also divided itself into two groups: a small group of engineers and chemists, of which the writer was chairman, and a large group of public-health personnel. Each group had more general discussions than arose on the prepared papers; the two group reports were presented to the full conference. It may be of help to those concerned with the control of air pollution in Britain to know something of the prepared papers and of the other discussions.

Before the conference a questionary was circulated to selected participants concerning air pollution and its control in their own countries. The answers to these questionaries were collated into a valuable document which gives a synoptic picture of atmospheric pollution in Europe. One great difficulty which this document demonstrated is that the diagnostic and pathological criteria for certain " air-pollution " diseases vary from one country to another. For example, the death rate from bronchitis in 1955 was 64·8 per 100,000 in England and Wales and 6·1 in Denmark; no doubt there are, in fact, less bronchitis deaths in Denmark than in England and Wales, but it is difficult to believe that part of the difference does not arise from discrepant diagnoses. The public-health group made the useful recommendation in this respect that a study group should be set up to rationalize the diagnostic criteria of those diseases which might be expected to be related to air pollution.

Again and again it was emphasized in the discussion on this general report that the ill-effects of air pollution in many countries were aggravated by topographical and meteorological conditions, for example the London " disasters " in 1952 and 1956, when atmospheric stability over the London basin held air pollution near the ground. This point was not forgotten in the Final Report in which the Con-

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ference urged that town and country planning authorities should bear in mind air pollution when siting industry in relation to residential areas. The Conference also felt that all new industries should be required to take adequate measures to avoid the creation of new sources of pollution.

A reading of this introductory report made it clear that, although no one in Britain can be satisfied that air pollution has been overcome, this country leads in systematic measurement and in control. The Alkali Inspectorate, for example, appeared to have no exact counterpart in the other countries. (Mr. W. A. Damon in introducing his paper rather astonished many of his hearers by telling them that during his 40 years' association with the Alkali Inspectorate there had been only two court cases, one of which was a " friendly " case on a point of law.)

There appeared, also, to be two schools of thought on " tolerance levels " for air pollution. Some participants—and the writer is with these—felt that the setting up of legal standards of maximum pollution in the air was stultifying. Legal standards must be so drawn that the least efficient can " reasonably " achieve them and so must be very much lower than the most efficient can achieve. Other participants, who seemed to be harassed by local difficulties of administrative control, insisted on the need for standards, which they wanted to see laid down internationally. It appears to the writer that the demand for absolute standards stems from an insufficient technical knowledge which would permit the intelligent assessment of each air-pollution problem on its own. And similar reasoning, though with perhaps less force, holds against the adoption of too rigid effluent standards. On the other hand, there may well be a good case for local standards, which can take adequate account of local meteorological and topographical conditions and of technical " know-how " in the area.

Levels of tolerance have been fixed in France and it is noteworthy that under normal working conditions the capacity of smoke emitted must in no case exceed Ringelmann shade 1 (one-half of the opacity adopted in the *Clean Air Act*, 1956).

The industries that came in for rather general criticism were oil refineries, cement works, sulphuric-acid plants, steelworks and power-stations. There were some medical men who wished to see the Conference suggest universal control measures of oil refineries and cement works. In some large cities it was felt that motor vehicles made a significant contribution to the total pollution and, in Paris, traces of lead had been found from the tetraethyl-lead in petrol.

It is difficult to compare the rural and urban populations in the various countries, but it seems clear that Britain has the highest proportion of its people living in towns. In the countries which are more predominantly rural there was frequently complaint of the damage of plant life by air pollution. We were shown some horrifying colour slides of damage by sulphur dioxide and fluorine. In Luxemburg there were complaints that bees had been killed by arsenical dusts from the metallurgical industries.

The proportion of the total pollution that comes from domestic chimneys, from industrial fuel-burning appliances and from industrial processes varies greatly from country to country and from place to place within each country. It is clear, for example, that most countries do not have the same burden of domestic pollution as Britain. Nevertheless it is interesting to note that a recent study of air pollution in Paris seemed to show that in winter traffic accounts for 30–40 per cent. of the total pollution and domestic heating for about 50 per cent.; in summer 70 per cent. of the fumes measured were given off by motor vehicles.

Atmospheric Pollution in the United States

After the general discussion on air pollution in Europe Mr. F. Tetzlaff,

of the U.S. Public Health Service, introduced Professor Drinker's paper on " Air Pollution Problems in the United States." The air pollution in the U.S.A. is more predominantly industrial than in Britain. And the domestic pollution is being still further reduced by the steady conversion to oil and natural gas: in 1900, 90 per cent. of the fuel used was solid (of which wood was still quite an important proportion), today 70 per cent. is oil and gas.

In the U.S. the Federal Government can concern itself, in the public-health field, only with " interstate " problems, e.g. quality of water on interstate railways, etc. The control of air pollution is a state problem, in many cases delegated to the city and county authorities. In some areas the control is very effective, both legislatively and technically. The U.S. Public Health Service, a Federal body, is devoting its principal energies in this field, therefore, to research and to training.

Sums that seem astronomical in Europe are being devoted to this research which has four main divisions: the nature of the troublesome polluting agents and their concentration, the source of those agents, the relationship of meteorological conditions to natural ventilation and to the aggravation of the ill-effects of atmospheric pollution, and methods of control. The kinds of polluting agent that at present are especially exercising the Americans are oxides of nitrogen, ozone and other oxidizing agents in the air, unsaturated hydrocarbons, aldehydes, etc.

The outstanding increase in motor vehicles in North America, especially in such areas as Los Angeles, has drawn attention to the internal-combustion engine as an important source of air pollution. At a later session of the Conference Mr. Tetzlaff and Dr. H. Heimann, also of the U.S. Public Health Service, gave an interesting discussion of this sphere of air pollution. A normal car engine exhausted 4–7 per cent. of the fuel unburnt and it appeared, from the Los Angeles investigations, that the olefines in this unburnt fuel were oxidized in the air by the sun with the assistance of oxides of nitrogen. The products of this reaction were irritating to the eyes and nose. The carbon monoxide given out by petrol engines was not usually important, but might have a significant effect on heart and anaemia sufferers. Automobile exhausts were known to emit small quantities of substances that were carcinogenic to animals or that were co-carcinogenic. The addition of tetraethyl-lead to motor fuels had resulted in some emission of lead in a finely divided form. Fortunately the quantity of lead actually leaving the exhaust at low speeds is small; when, however, the car reaches high speeds, normally outside the urban areas, the lead deposited in the exhaust pipe is discharged.

The problem of automobile pollution was being tackled in a number of ways. Early experiments in Los Angeles had suggested that a substantial part of the unburnt fuel was discharged during deceleration. The American automobile industry has, therefore, designed automatic controls to cut off the fuel at this stage. In addition afterburners have been designed to consume the unburnt fuel, either by direct combustion by a sparking plug or in a catalytic bed. The common catalysts were fairly rapidly poisoned by the lead in most fuels; a search was going on for a suitable catalyst. But this kind of catalyst was already in use for diesel lorries. Experiments were also going on to take up the oxides of nitrogen in activated carbon beds.

Biological Effects of Air Pollution

In the session devoted to this topic there were four papers:

" Biological and Health Aspects of Air Pollution " by Professor A. Giovanardi, of the University of Milan;

" Studies of Sanitary Nuisance and Health Hazards from Flue Gases" by Drs. L. Friberg and L. Strandberg, of the Swedish National Institute of Public Health;

" Air Pollution and its Influence on Vegetation " by J. G. Houten

and F. Spierings, of the Dutch Institute for Phytopathological Research; and

" Air Pollution and Plant Life " by Professors E. Baldacci and V. Ceccarelli, of the University of Milan.

In his paper Professor Giovanardi reviewed the health effects of air pollution and, as with all stimulating papers, posed a number of questions, solutions to which must be found before we can intelligently base air-pollution control on its capacity to increase morbidity and mortality. He emphasized that health is not only qualitative, it is also quantitative, and that control must be based on a statistical approach of this kind. This same approach must be adopted in basing maximum tolerable limits on toxicological evidence. Irritant substances such as sulphur dioxide are probably important to health, but, at present, we do not know quite how they act on man. An epidemiological approach to the relationship of air pollution to disease is complicated by the fact that there are no specific " air-pollution " diseases, analogous, for example, to cholera and other typical waterborne ills.

The Swedish authors describe an interview-survey method for studying the effects of atmospheric pollution on health and comfort that may have considerable value.

The special interest of the Dutch paper is that it indicates the value of plants as indicators of atmospheric pollution. The authors found that a gladiolus " Snow Princess " was especially sensitive to hydrogen fluoride. Leaf analysis always showed less than 10 ppm. HF outside the industrial area: at values above this leaf damage gradually became noticeable. Leaf analysis was also of value in demonstrating fluorine damage in a range of plants. The test plant adopted for demonstration of sulphur dioxide was lucerne, which, however, did not show slight sulphur damage by leaf analysis. The Italian authors gave a detailed account of the value of a large number of plants as pollution indicators and Dr. Schinzel, of Austria, described the use of lichens for the same purpose.

Physical and Chemical Aspects

Most of the papers presented in this session were concerned with pollution data and we need not here concern ourselves with them. Messrs. Bergshoeff and Brasser, Dutch Research Institute for Public Health Engineering, prepared a useful review of a number of sampling techniques and of the measurement of small concentrations of sulphate. In addition to the common type of deposit gauge the Dutch workers used an aluminium globe coated with petroleum jelly which collected dust from the air. For gases it is possible to expose fabrics, impregnated with solid or liquid reagents; the gases concerned react with these materials and can be determined periodically by chemical analysis. The British lead-peroxide candle is our example of such a gauge.

With most types of long-period instruments there is a fairly large variation in the result obtained by the same type of gauge. For example, two standard deposit gauges were set up side by side at Kew. Over a number of years the standard deviation in the measured dissolved matter was 24 per cent. and of the undissolved matter 16 per cent.

Over short periods " absolute " determinations of atmospheric constituents may be made. Typical equipment consists of a pump, collector and airflow meter. Even here quite large percentage variations will occur because the quantities measured are small.

One of the most valuable papers presented to the Conference was that on " The Control of Noxious Gases and Fumes Discharged from Industrial Undertakings " by Mr. W. A. Damon, former Chief Alkali Inspector, Ministry of Housing and Local Government. Mr. Damon's thesis, which has been admirably worked out in his paper, is that, if expense were no object, it would theoretically be possible to avoid all forms of pollution. In

practice, however, there must be a compromise between the desire for a clean atmosphere and financial possibilities. This compromise is achieved by the honest adoption by pollution-producers of " the best practicable means " of prevention. This is really the basis of the British attempts at improvement in this and related fields; it can be much more profitable than the intransigent application of certain supposed Common-Law principles. The prevention of air pollution is more likely to be effective if it is one of the factors borne in mind at the outset of planning a new factory or process.

Engineering Aspects of Air-Pollution Control

The opening paper in the session devoted to this topic was by Professor Cambi, of the Milan Polytechnic, on the rôle of the sanitary engineer in the assessment and control of air pollution. It was a long and most detailed study of the nature and source of air pollution, of its measurement and control, and of further research required in this field. We cannot here do justice to it.

Two doctors from Rotterdam, Drs. de Graaf and Tesch, gave an account of some aspects of air pollution in their city, which is being rapidly industrialized after wartime destruction. The City set up an " inter-departmental committee " on Soil, Water and Air; this, in turn, set up sub-groups concerned with air pollution from particular groups of industries. These sub-groups co-operate with the industries concerned. Those first studied were fluoride-emitters, oil refineries and incinerators. The public health department has attempted to relate mortality rates to air pollution, but, as might be expected, without any clear result. The fluoride-emitters are three superphosphate factories and an enamel-grit plant. Much has been done to control these emissions, but horticultural damage is still occurring and it is thought that coal used in power-stations may be a substantial contributor.

Professors Paccagnella and Dechigi discussed air pollution in relation to town planning.

Administration, Legislation and Training

The final session on these topics need not long detain us, although they are, in fact, quite as important to the control of air pollution as the more technical aspects. Once again it became clear that most European countries had not achieved the degree of organization for local control that has been reached in Britain. Dr. H. E. Seiler, Medical Officer of Health for Edinburgh and another of the three British representatives, gave a valuable paper on these topics. He—and the present writer, who gave the last paper on " Training for Air-Pollution Abatement "—believe that perhaps the most important need in cleaning up our atmosphere is the support of an informed public opinion. This places an emphasis on health education, which must be achieved through local groups such as Women's Institutes, through the schools and so on. Boilermen and plant operators, professional engineers and medical men should each receive at least an introduction to the problem of air pollution and an indication of the contribution which they can make to its abatement.

Conclusion

The Conference sessions were illuminated by visits that we paid to the Merone cement works, to the Dalmine steelworks, to the Sanitary Engineering Institute of the Milan Polytechnic, to the Condor oil refinery and to the Societa Nazionale Metanodotti.

Amongst the positive recommendations made by the Conference the following may be mentioned:

1. WHO should collect and disseminate information on air pollution. As a first stage the Organization should compile a list of the various organizations carrying out research on air pollution.
2. A national advisory committee on atmospheric pollution should be set up in each country.

3. Co-operation between the various professions concerned with industrial construction should ensure that new processes were designed and new plant built to avoid producing pollution from the start.

4. A multilingual glossary of terms should be prepared and international agreement should be reached on uniform expression of measurements.

5. The work of the OEEC in assessing the value of various methods of measurement should be followed up, where and when appropriate, by international standardization of suitable equipment.

6. All those who may produce air pollution should receive some instruction in this topic, together with methods of control. Undergraduate courses in most fields of engineering and in medicine should contain an introduction to this matter. Courses for boiler operators should be extended and should be encouraged by licensing boiler operators or by wage incentives.

7. Health education of the public concerning air pollution should be much increased and should be especially directed to the young.

SMOKE PREVENTION ABSTRACTS

297. Effect of Fuel Oil Additives on Low Temperature Corrosion and Smoke. Murray, G. F. J. (Central Electricity Authority, undated, " Report of Conference on Oil-firing Problems, October 1956," 197–202). The claimed effects of various additives are considered briefly. Low temperature corrosion in oil-fired boilers due to sulphur present in the fuel oil may be reduced by injecting additives. Tests were made using different additives to determine their effect on the amount of sulphur trioxide produced and on the acid dew point. The addition of ammonia later in the system to the flue gases, where the temperature was about 350°C., gave good results. By an addition of up to 0·08 per cent. ammonia, by weight, the acid dew point was eliminated and a water dew point obtained. Corrosion using ammonia was 0·2 mg/h as compared with 6·6 mg/h without any additive. A suggested ammonia additive system is outlined. Atmospheric pollution by flue gases may also be improved due to reduction of sulphur trioxide and agglomeration of particles. A note is included on smoke measurement since it is felt that the Ringelmann number scale and percentage obscuration method is not the correct one for estimating the degree of air pollution. The direct method used by the British Petroleum Co. draws in a quantity of gas through a filter paper and compares the depth of stain made with a standard scale known as the " Shell Standard." (D.S.I.R.)

298. The Emission of Sulphur Gases from a Domestic Solid-fuel Appliance. Crumley, P. H. and Fletcher, A. W. (J. Inst. Fuel. **30,** 608, November, 1957). The waste gases from the combustion of solid fuel in domestic fires and stoves are an important source of atmospheric pollution, but little quantitative work has been done on the amounts of harmful gases emitted. The concentration of some of the more important of the harmful gases, particularly the sulphur gases, have therefore been determined in the flue gases from an openable stove of a type commonly used for domestic heating.

The authors say that from the point of view of possible pollution of the air of the living-room, the results obtained in this work suggest that with a given solid-fuel appliance the amount of sulphur entering the room when there is a down-draught will not be greater with coke than with coal. A down-draught, when burning coal, especially during the initial stages of combustion, will cause visible smoke to enter the room. Although this smoke may, as shown in this work, contain a higher concentration of sulphur gases than the " fumes " from a coke fire the

pungent odour of distillation products may mask the presence of sulphur gases. With coke, however, the sulphurous odour of the fumes is the only evidence of down-draught. The householder therefore gets the impression that coke is liable to cause more sulphur pollution of his living rooms than coal. Although this is untrue as far as total sulphur is concerned, more sulphur trioxide is emitted from coke than from coal fires. However, with the low concentrations involved, it may be doubted whether this difference in the amounts of sulphur trioxide could account for the characteristic odour of coke fires.

299. The Coal Industry and Fuel Technology in the U.S.S.R. Jones, W. Idris. (Paper presented to the Institute of Fuel, 19th December, 1957.) A survey of the coal industry and fuel technology in the U.S.S.R. which has been based partly on personal experience and partly on Soviet literature. The natural fuel resources of the country are extensive and reserves exist to meet the consumption of coal, according to the present plans, for some hundreds of years. Over half the fuel requirements of the country are provided by hard coal, just under a quarter by lignite and most of the remainder by oil and peat. Details are given of the Soviet coal industry based on personal experience and the general pattern of oil production and some details of the refinery situation are outlined. The main coal-producing areas are shown on a sketch map whilst a second map gives details of oil fields, oil refineries and natural gas pipelines. The outline of fuel resources is completed by short sections on hydro-electricity and nuclear energy. The development of boilers and of steam engineering in the U.S.S.R. is comparable with that in Western Europe. The Russians have been able to maintain a similar pace of development to other countries by an extensive programme of education and research. The general pattern of research and development is outlined, with particular details of mining research, and the paper concludes with a brief outline of the position of education in Russian life today. (Author's Abstract).

Business Appointments

Bennis Combustion Ltd.—James Hodgkinson (Salford) Ltd., have acquired a controlling interest in Bennis Combustion Ltd. and their subsidiaries, the Saxon Engineering Co. Ltd. and Bennis Mechanizations Ltd. Three Hodgkinson directors, N. C. Crichton, E. L. Hollinshead and J. S. Hodge, have been appointed to the Board of Bennis Combustion Ltd. The trading of these respective companies will continue under their own names.

S. Thomson, Director and General Manager (Sales) of **Ideal Boilers and Radiators Ltd.,** has retired and F. L. Shaw, who has been with the company for many years, has been appointed to the position. Mr. Thomson has also relinquished his position as Chairman of the Cast Iron Heating Boiler and Radiator Manufacturers' Association.

Radiation Ltd. announce the appointment of A. J. Parker as Managing Director. Mr. Parker, who was appointed to the Radiation Board in 1954, is a specialist in industrial management and has been actively concerned in production engineering for many years.

The Board also announce the formation of a new company, Radiation Group Export Sales Ltd., which will take over the export selling activities of all the subsidiary companies in the group. The Managing Director is J. Ivan Yates, a member of the parent Board.

Eric Bellingham, General Manager of Solid Fuel Appliance Sales, has been made a Director of Radiation Group Sales Ltd.

Prior Approval in Practice

by

J. H. Wyatt, M.A.P.H.I.

Deputy Chief Public Health Inspector, Leeds

Excerpts from a Paper read at a meeting of the Royal Society of Health in Leeds on 22nd January, 1958

Section 3 of the Clean Air Act introduces a most important provision, inasmuch as for the first time new furnaces which are installed are required to be capable of being operated continuously without emitting smoke while burning fuel of a type for which they were designed. The furnaces concerned are, in general, industrial furnaces and other large furnaces such as may be found in hotels and blocks of flats, but not small domestic appliances which have a heating capacity of less than 55,000 B.Th.Us per hour, or moveable furnaces which are not fixed on any land. The Section also provides that formal notification must be given to the local authority when new furnaces are to be installed, and also that plants and specifications may be submitted to the local authority for approval so far as Section 3 of the Act is concerned. In other words, if a furnace is approved it is deemed to be capable of continuous operation without emitting smoke when burning the correct fuel. The importance of this latter provision lies in the fact that when the Act comes fully into force, offenders against Section 1 (which refers to the emission of dark smoke) who are using newly-installed plant which has not been approved, might also be proceeded against for using equipment which is not capable at all times of operating smokelessly.

Since the Act came into force we have received a number of notifications of intention to install new furnaces. In the early months the installation of such plant generally came to our notice through the submission of building plans to the City Engineer, and we made a point in every such case of bringing to the architect's notice the need for formal notification. In consequence, architects, engineers and builders have gradually become aware of the necessity to notify. Incidentally, we have insisted upon a formal notification in writing being sent independent of the plan submission. No standard form of notification has been devised, a letter giving details of the plant has been regarded as sufficient, when such details have been received we have made it a practice to draw attention to the provisions of the Act relating to prior approval.

Decisions on these applications have been made by the Council solely on the advice of their own officers, and so far no consultant or outside advice has been found necessary. Leeds has, of course, a number of officers who are technically qualified to advise the Council, but if any application submitted in the future should offer special difficulties, consideration would be given to the desirability of securing the services of a consultant in connection with that particular application. I know that in some areas advisory panels have been set up to consider such applications, and of course this system has advantages where technical advice may not be readily available. At the same time, it is my opinion that the procedure of convening the panel, considering the proposals and negotiating amendments would undoubtedly increase the time involved at present in obtaining approval. It is, of course, greatly to the advantage of a Council

to be able to comment upon proposals for new plant, and anything which might discourage applications is undesirable. I think that delay in negotiation could be a factor in discouraging such applications. In a large town such as Leeds there are cogent arguments in favour of delegating such work to full-time officers of the Council, who can deal directly and speedily with the engineers concerned and obtain any alterations or amendments considered necessary before the application is referred to Council for approval.

We have found that although firms are prepared to submit applications, they are, in many instances, extremely reluctant to produce detailed specifications. In fact, we have been forced to the conclusion, in some cases, that no proper specifications have been drawn up. Allied to this, some applicants do not appear to be able to make up their minds; we have had amended schemes submitted after approval has been given. With regard to new central heating plants, we find that some firms are loth to produce their working figures for calculation of heat losses, although there is nothing particularly complicated about these, and of course, unless in such cases we were to assess the heat requirements of the building ourselves, it is impossible to check boiler reserve margins. We have found difficulty occasionally in deciding whether or not a particular appliance is or is not a furnace.

The Act appears to envisage a straightforward approval or rejection of proposals and contains no provisions for conditional approval. We have, however, rightly or wrongly, approved most of our applications conditionally. We have thought it wise, for instance, in all cases where the chimney top cannot be seen from the boiler-house floor, to require the provision of a smoke alarm in the chimney base, and in cases where it was considered likely that grit might be thrown off we have required the provision of sampling holes at strategic points in the flues. In one instance—a refuse incinerator—we asked for, and obtained, a water-spray chamber to prevent the emission of charred paper and light ashes. We have no very strong preconceived ideas about the type of plants which we would or would not approve, but we would not normally approve any hand-fired appliances for coal burning, nor would we be inclined to approve sprinkler stokers firing coal. We also would not approve the installation in a smoke control area of plant which did not use authorized fuels or liquid fuels. We think that any coal-burning plant which is not properly instrumented ought not to be approved.

No standard form of approval has been adopted—we have thought it sufficient to notify applicants by letter. We have not considered it necessary to repeat details of specifications but have simply referred to these in the approval letter.

Dutch Smokeless Fuel

The Dutch State Mines operate a pilot plant of over 100 tons a day capacity for the production of smokeless fuel. This plant consists of four groups, each of three Disticoke ovens with inclined chambers. Using 100 tons of briquettes as the feed, 87 tons of carbonized ovoids, three tons of larger pieces and five tons of fines are obtained. The finished product resembles that obtained in the Phurnacite installation at Aberaman; it contains 5 per cent. of ash and 5 per cent. volatile matter. In an endeavour to keep down the capital costs and also the running costs, another way of carbonizing the charge was studied. The pilot plant incorporated a travelling grate and had a capacity of 660 lb. an hour. The quality of the finished product was nearly the same as that from the chamber type of oven. Initial difficulties of fissuration, due to excessive rate of temperature rise when the briquettes were in the plastic state, have been overcome by very precise control of the rate of heating.

Where the Air is Really Clean

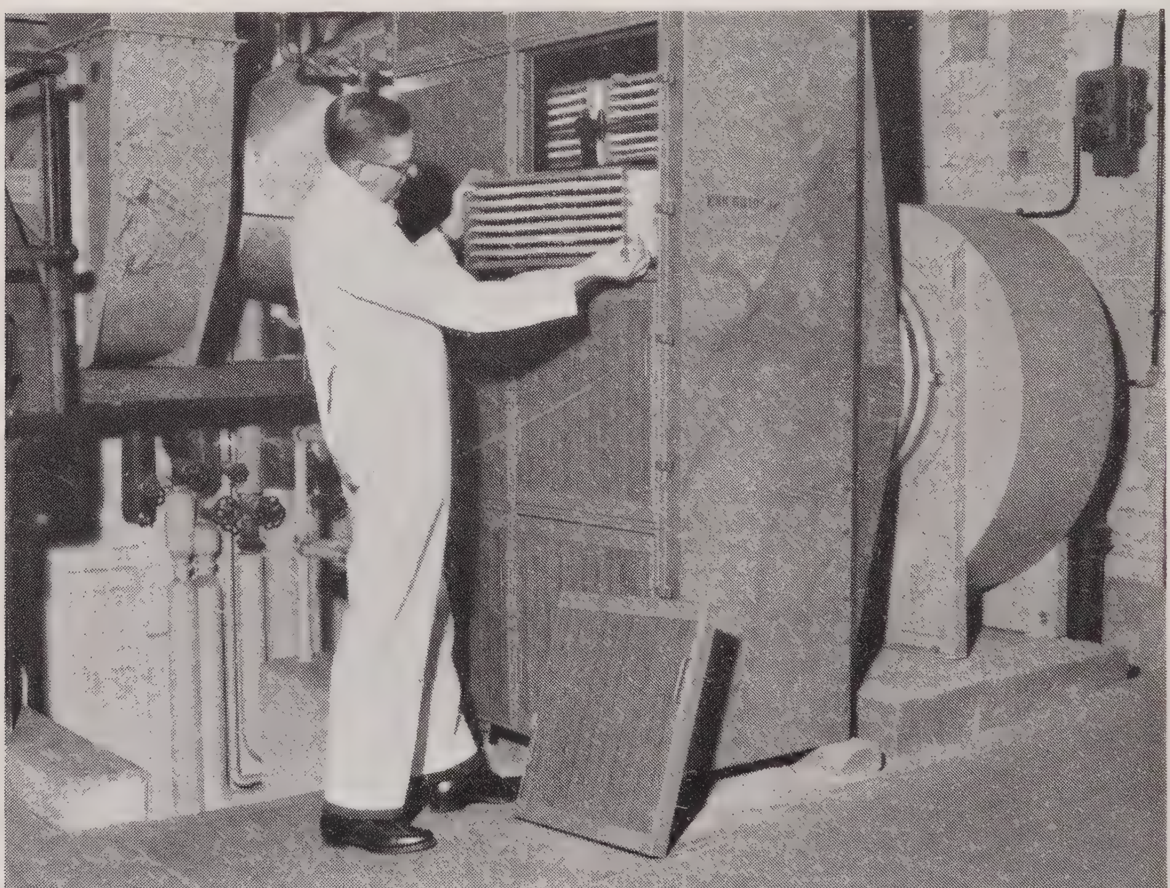
Purity Essential for Photography

CERTAIN industries are pleased enough to see that something is being done about air pollution; but even the most exacting legislation does not completely solve their problem. In fact, it is difficult to conceive of the Act which would do that. They are the industries whose definition of " clean air " is out of this world, and for whom industrial and domestic smoke is only one aspect of pollution.

The air is full of a thousand deleterious substances, for instance, for the makers of photographic film. A photographic emulsion, compounded of gelatine and silver halides, is designed to react to light, but unfortunately it also reacts to practically anything that the air can carry. Where emulsions are being handled, chemical fumes, oil spray and smokes must, of course, be excluded absolutely—but so must textile fibres, human skin flakes such as dandruff, vegetable pollens, metal dusts and harmful effusions from materials.

Faced with such exacting conditions, the photographic manufacturer can do only one thing—produce his own air, clothe his workers from top to toe in continuous-filament nylon (which gives off no fibrous particles), and clean every item of equipment or material before it enters the working area.

For instance, at the Ilford Limited factory at Brentwood, Essex, the machines which dry the emulsion on the film-base are totally enclosed in an air-locked building, and are fed air at slightly above atmospheric pressure and at controlled temperatures and humidities. In this nylon-clothed workers operate.



Changing Filters on a Ventilating Plant at the Ilford Works

Worker in Nylon Suit

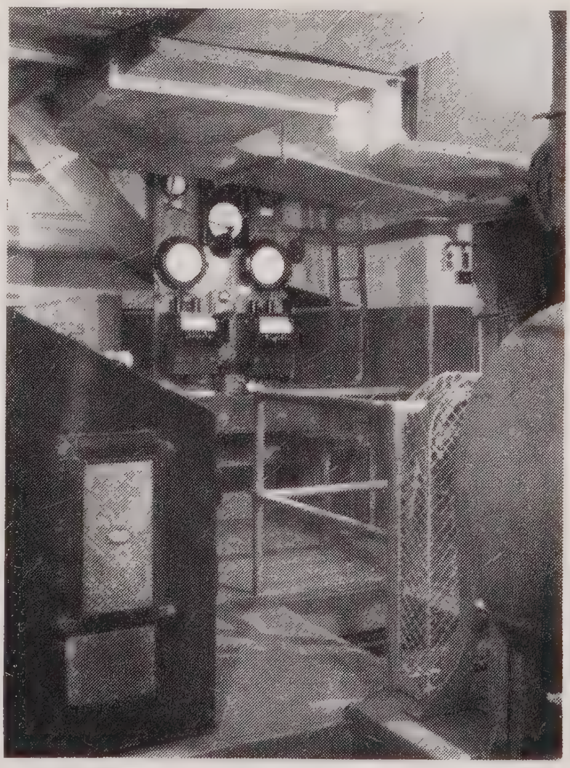
Even in the relatively rural surroundings of Brentwood, the air, thick with dirt, soon clogs the coarse blanket filter of the first stage of purification. At the next stage, where the air is put through a distilled-water scrubber, the inspection door shows the typically yellow tone of industrial smokes. The air is then warmed and humidified and blown through to the working area, where a third stage of cleaning is carried out with vacuum devices close to the actual point of drying.

Even in the working area, dusts and harmful fumes can arise. To prevent these, the walls are coated with special high-gloss paints, and jointings are avoided. The floors are of terrazzo, from which the dust, if any, is at least chemically inert; the unavoidable jointings are in hard rubber.

No powder abrasives are used for cleaning, only petrochemicals. Portable vacuum cleaners are constantly at work, and the household chamois leather (for which no good substitute has yet been found) is much in evidence. Even when ordering or constructing equipment, Ilford Limited have to think of everything that might create dust particles. Most machinery bearings are of nylon, to avoid metal dusts; no soft woods are used, for they would flake and give off turpentine fumes; surfaces of vessels are stainless steel with a mirror finish, because most platings chip.

The result is that, within this drying area, the company claims to have the cleanest air in Britain. Of course, a photographic manufacturer has two great advantages over his fellow industrialists in this matter—first, most of his processes take place in the dark, and therefore require no window-piercings in the building structure through which dirt and dust might leak; and second, he has a perfect test for their presence. Samples of the film are tested continuously by development and enlargement, and as anyone will know who ever let dust get inside his camera, foreign matter shows up at once.

But this clean air " plus " is an expensive commodity. In the giant drying section alone, half the volume of the building is taken up with the air-conditioning and cleaning equipment alone; the cost in terms of cubic feet per hour may well be imagined. In the elementary text-books on economics, air is often spoken of as an example of a " free commodity "—you will not find that Ilfords think so.



Control for Air Conditioning

The Scientific Study of Air Pollution

AN announcement was made in our Autumn number of a series of lectures to be given in London, with the above title, under the auspices of the Extra-Mural Department of the University. This interesting series has now been completed.

The series was opened by a Survey of the Pollution Problem, by Dr. W. C. Turner, Medical Officer of Health, Poplar. Dr. Turner first reviewed the various types of natural pollution. In the course of so doing he pointed out that some of the apparent blackening of buildings by soot was in fact the work of fungi. He pointed out, however, that many fungi would use the sulphur pollution in the air as food, and therefore the greater the pollution, the greater the corrosion due to fungi.

Some forms of gaseous pollution, Dr. Turner continued, arose from organic decomposition. He instanced two cases in which the creation of anaerobic conditions in water had given rise to pollution by hydrogen sulphide. He also pointed out that flue gas washing could create such anaerobic conditions in rivers, by saturating the water with large quantities of calcium sulphide and sulphate.

Dr. Turner pointed out that too often safe conditions inside a factory where toxic processes were being carried out or materials used, were created by venting to atmosphere, to the detriment of people living in the vicinity.

Dr. Turner devoted the latter part of his paper to the formation of pollution from industrial furnaces and domestic fires. He said that in the country the size of particles in a fog soon increased to a point where they settled out. In a town, however, the smoke particles caused the fog droplets to be so small as not to fall out readily. It was abundantly clear, he concluded, that any attempt to avoid smog conditions must be directed primarily at diminishing the output of smoke particles from the domestic fire.

This lecture was followed by three lectures by Dr. R. S. Scorer of Imperial College on the relationship between meteorology and air pollution.

Dr. Scorer said that pollution was diluted by the wind, by stirring motions aroused by movement of air over the ground, and by stirring motions due to thermal convection over sun-warmed ground. The accumulation was increased by stabilization of the air (*e.g.* over a snow surface or at night) when the lower layers are cooled, and when the wind becomes light. The operation of all these and other minor processes was so complicated that no general formulae could be given for the pollution from a single source.

Two main points emerged, said Dr. Scorer. First, it was important to consider whether any remedies to abate pollution should be applied all the time or only on occasions when the damage was commensurate with the cost of pollution. Second, it was important in considering the remedies to make an estimate of the cost of damage attributable to the source.

The next lecture in the series was given by Professor P. A. Sheppard, Professor of Meteorology at Imperial College, who spoke on the Effect of Pollution in the Heat Balance of the Atmosphere. Professor Sheppard said that with a polluted atmosphere there was somewhat less ground cooling than with a clear atmosphere but a greater amount of cooling by radiation in the first kilometre or so of the atmosphere. Although the effect might be confined to a narrow layer and so be of no great consequence directly to the thermal balance of the lower atmosphere, the cooling was important dynamically in stabilizing the atmosphere and preventing the escape of pollution into higher levels.

Professor Sheppard was followed by Dr. H. Joules, of the Central Middlesex Hospital, whose lecture was

devoted to the Effects of Atmospheric Pollution on Health. Dr. Joules said that the effects on general health were shown by the psychological effects, which resulted in much ill-health, especially during the period January to March; the effects due to lack of sunshine; and the increased mortality and illness in children under one year in industrial centres.

Turning to lung diseases, Dr. Joules said that bronchitis was extremely common in Britain, probably more so than in any country in the World. It was five to six times as common in polluted industrial towns as in seaside resorts.

Speaking of smogs, Dr. Joules thought it probable that sulphur dioxide was the most important pollutant in serious smogs and in continued pollution. Smogs gave rise to sudden death, to prolonged illness in those already bronchitic, and started a cycle of recurrent bronchitis in those predisposed. Doctors could not cure severe chronic bronchitis.

Dr. George Elton gave the seventh lecture, on the Physical Chemistry of Fog. Dr. Elton described the formation and properties of fog as occurring in nature, and methods of measurement. He also described experimental methods of producing fog, and possible means of dispersing it.

D. G. Lucas of the Central Electricity Authority then gave two lectures on Field Research, in which he described the methods of measurement and the formulae used in C.E.A. field studies of pollution from power stations.

The last lecture was given by Arnold Marsh, Director of the N.S.C.A. Mr. Marsh said that past legislation had not been without value, but had serious weaknesses.

The importance of the new Clean Air Act, said Mr. Marsh, lay in the new principles it introduced. The first of these lay in ensuring that new plant and appliances (both industrial and domestic) should be capable of being used smokelessly. The second was that the emission of dust and grit was controlled separately from smoke. The third new principle was that of the smoke control area, introduced principally for the prohibition of domestic smoke, and based on the successful smokeless zones that had been established during the past decade.

Dust from Cement Works

An excellent survey of the problem, with particular reference to the indirect and direct effects on health, by Dr. J. H. Hudson, Medical Officer of Health, Dartford Borough and Rural District, was published in *The Medical Officer* for 20th December, 1957 (pp. 351–356).

The author finds that the evidence for direct effect on health, as might be shown by mortality rates, etc., to be negative. In fact there is a possibility that the chalk and lime suspended in the air is diverting the acid oxides of sulphur and thereby preventing their harmful partnership with smoke particles. The freedom from acid and the high sulphate content of the deposit gauges, it is said, seem to fit in with such a picture.

Dr. Hudson stresses, however, a factor that is only too often overlooked. His remarks are best quoted in full:

" The mental reaction which this dust provokes is, as any housewife will agree, a matter about which I am unqualified to write. Nevertheless I will make the attempt.

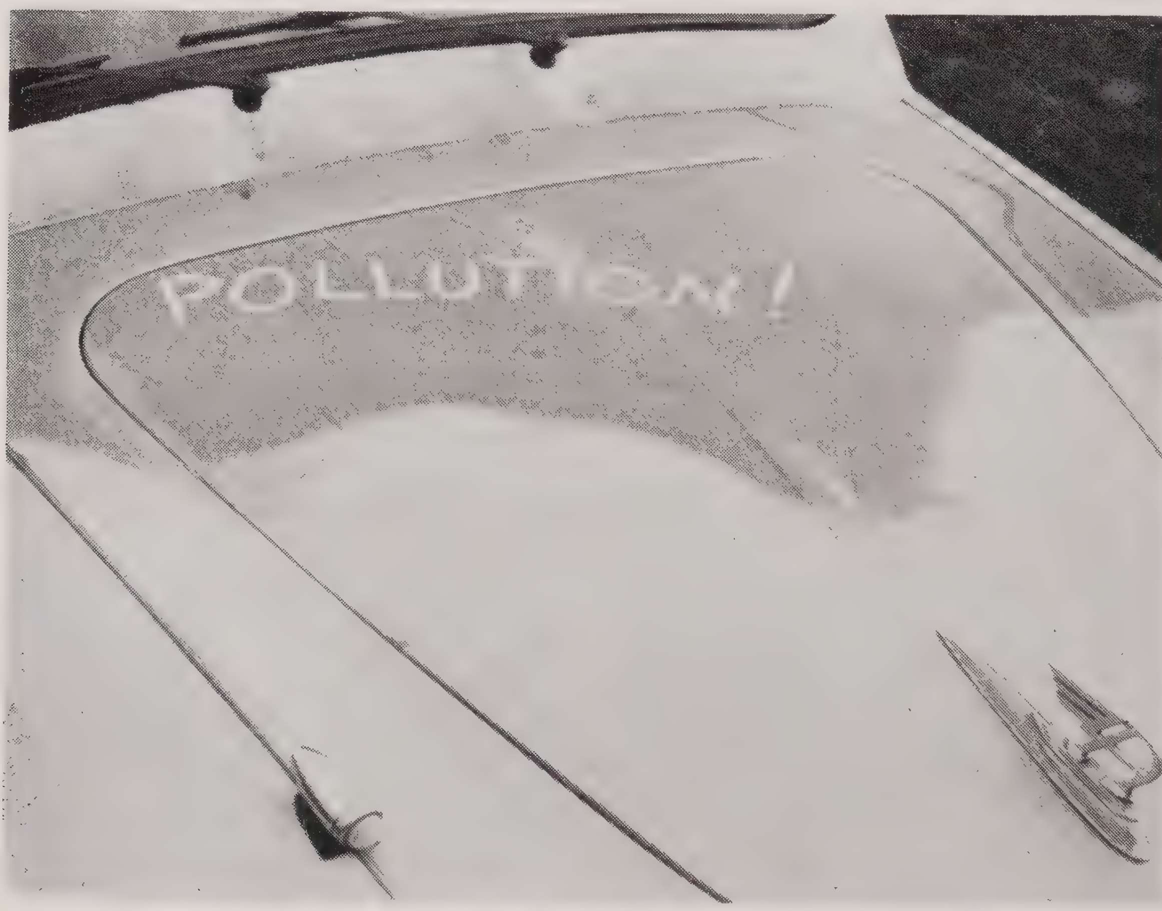
" Perhaps to a few people, most of whom live away from the dust, it gives a sense of security at the evidence it

provides of economic prosperity. But to others it is said to cause depression through the dustiness of their homes and the dry drab grey colour of their surroundings.

" On windless days the dust forms a haze that interferes with the penetration of sunlight but such a haze is limited to a defined area which will change with the arrival of a breeze. The dust is not incompatible with a blue sky; it does not visually hang about like the smoke pall of industrial towns. That deposited on buildings and vegetation is cleaned off by heavy rain and does not stick like grimy soot. Admittedly some roofs near the cement works seem to have an adherent deposit but presumably this is due to cement dust rather than the dust that afflicts the remainder of the district.

" Cement manufacturers are big landowners, they can sell as much cement as they make, they do big business, they are presumably wealthy and they are referred to as 'the combine,' a word which for some people has sinister associations. With this background, ideas tend to form into a pattern which interprets the presence of this dust as the exploitation of our powerlessness to enforce a remedy.

" The local authorities have done much to make known both sides of this problem and no doubt their efforts have both stimulated the cement manufacturers to improve their dust arrestment and engendered patience in the public. Immense sums have been spent on that arrestment and we hear that more will yet be spent."



From Our Photo-Library, No. 31 *Major F. H. C. Birch, R.A.*

WRITTEN COMMENT

(*This shows the deposit of soot and cement works dust on the freshly washed and polished bonnet of my car during the 36 hours I was foolish enough to leave it out in the open in Orsett Camp, near Grays, Essex—F.H.C.B.*)

REPORT ON A QUESTIONNAIRE

Inquiry to North West Local Authorities

THE North West Division of the Society recently submitted a questionnaire to local authorities in its area, asking for information on certain aspects of the air pollution situation. In all, 259 questionnaires were sent out, of which 163 were returned, including 75 *nil* returns. A report on the replies has now been made to the Divisional Council, with the questions asked and a summary of the answers, as follows.

Have any special measures been taken to deal with possible air pollution from (a) industries with noxious fumes and gases; (b) electric power stations; (c) any other special air pollution problem in your area?

Questions (a) and (c) are interrelated. Many of the sources of pollution which come under these headings are referable to H.M. Inspector of Alkali, etc., Works. The following offensive industries and operations were specifically referred to in replies from 55 authorities: sulphur gases, metallurgical processes, fat smelting, canal navigation, gas manufacturing, rust removing, shipping, burning spoilbanks, soil sterilization, limestone crushings, oil refining, chemicals, copper smelting, tar distilling, paintworks, servicing of locomotives, slate mining, washing hog hair, briquetting fine coal, colliery dust, processing of rags and sisal, cotton linters, icanite, lithium, salt pan furnaces, rayon factory and wire enamelling.

Under (b), 9 authorities referred to potential pollution, but installation of electrostatic precipitators, grit arrestors, sulphur dioxide estimators, volumetric analysers, and in one case a 450 ft. chimney, have prevented or reduced pollution. The Central Electricity Generating Board appears to be alive to the question of atmospheric pollution.

What measures have been the most successful in their application to special air pollution problems in your area?

Fifty-nine authorities referred to successful action in their areas which included: the establishment of smokeless zones, prior approval of new installations, training of boiler operators, planning control, liaison with H.M. Alkali Inspectorate, personal contact with management, reference of problems to N.I.F.E.S., electrification, conversion to oil firing or mechanical stokers, building byelaws, imposition of time limit for emission of black smoke, action under the Public Health Act, 1936 (but section 94 (5) presents difficulties), and regular observations.

Have you any comments or complaints from the public, etc., as to the effect of air pollution on health or on vegetation?

On health grounds 32 authorities had had complaints, whilst comments and complaints of the effects on vegetation were included in 25 replies. Concern was expressed at the effects of strontium 90 by two authorities.

Are there any regular training courses in smoke abatement for works engineers and plant operatives? If so, is the course in question confined to engineers and operators employed in works in your own area or is the course available to and used by people from neighbouring areas?

Regular training courses are available in 15 authorities, whilst 22 authorities are able to use the facilities of a neighbouring area. In four cases the courses have been discontinued because of lack of support.

Do you provide any service on the prevention and control of special industrial problems of air pollution? Have you any specialist smoke abatement officers in the services of your authority?

Eleven authorities provide a service,

8 have specialist officers and 26 have Public Health Inspectors with Smoke Inspector's certificate.

Are there any activities carried out in your area for the education of the public on the subject of air pollution?

Only 25 authorities gave an indication of activity on education of the public, 22 of which consisted of spasmodic exhibitions and lectures as part of health propaganda. The other three authorities disseminated information by means of: *Smokeless Air* journal, volumetric apparatus in shop window, " Guilty Chimneys " leaflets, permanent museum available to schools and organizations, quarterly meeting of joint consultative committee.

If you have any recent reports on this subject, we would be grateful for copies.

Ten authorities sent recent reports covering the following subjects: Clean Air Act, 1956, Medical Officer of Health annual reports, residential smokeless zones, mica, steel slag, chemicals, gaseous and liquid effluents.

Natural Gas to be Imported

A contract has been signed between the Gas Council and the Constock Liquid Methane Corporation of America for the experimental importation into Great Britain of liquefied natural gas by sea. A cargo ship, jointly owned by the two bodies, is being converted and will be able to carry about 2,000 tons of liquid natural gas. It is hoped that the first shipload will arrive in the Thames within about a year. If the experiment is successful it is hoped that the way will be open, subject to Government sanction, to the bulk importation of the gas. The following article tells the story in more detail.

THERE are many parts of the world in which natural gas is found, but in which there is no local demand for fuel. In these circumstances, the natural gas is either sealed off, or, where it is found in conjunction with an oil well, may be used for re-pressurizing the wells or, for reasons of safety, be burned to waste.

Since the nationalization of the gas industry in Great Britain, increasing attention has been given to the possibility of making gas from sources other than coal, or of taking natural gas into town's supply. In the past the industry in this country has been almost entirely dependent upon coal as its raw material. The bulk of the gas manufactured is still produced from coal, but the type of coal needed for carbonization is in increasing demand for other uses, while the supply is diminishing.

It was for these reasons that the Gas Council began the search for supplies of natural gas in Britain, a search which is still proceeding in conjunction with the B.P. Exploration Company. Similarly, Gas Boards in various parts of the country have entered into agreements with the National Coal Board for the purchase of methane drained from coal workings.

The liquefaction of natural gas and its transportation in the liquid form presents no easy problem, for methane, the principal constituent of natural gas, requires a temperature of minus 260 degrees F. for liquefaction at atmospheric pressure and the material must be maintained under these conditions during transportation. When liquefied, however, the volume of the gas is reduced to 1-600th of the space it occupies in gaseous form.

Processes for the liquefaction of gas have now been developed to an advanced state and the major portion of the technical difficulties associated with these processes has been overcome thanks in a great degree to the development of materials capable of withstanding very low temperatures.

The storage of gas when liquefied is also a process for which there is adequate precedent and technical knowledge.

What is new is the attempt to convey, by ocean-vessel, fluids in insulated tanks at such extremely low temperatures. The success of the experiments now being undertaken by the Gas Council in conjunction with the Constock Liquid Methane Corporation will depend largely upon whether, technically and economically, this sea-borne transport has the results which are hoped.

The gas industry in this country has, during the past three years, devoted much time and attention to study of the technical and economic aspects of importing liquid natural gas. In addition to these developments, many organizations throughout the world are engaged on similar investigations.

The Trial Shipment of Natural Gas

It is proposed to take the first trial loads of natural gas from the Gulf Coast oilfields. For the trial shipment it is proposed to use an already existing liquefaction plant which has been constructed on a barge, and which can be transported to any site in the area at which the natural gas may be loaded. This plant has a capacity of about 8 million cubic feet of natural gas a day. The liquefied gas will be stored in tanks on shore before being loaded into the vessel for shipment.

The vessel which is being converted for the trial load is a double-bottomed cargo ship about 340 feet in length which, after conversion, will carry about 2,000 tons of liquid methane.

The liquid methane will be contained in five tanks insulated with balsa wood and their overall design and location will be such as to accommodate the effect of ship's movement at sea. As the liquid methane cargo is exceptionally light the ship will be specially ballasted.

The design and engineering work for the conversion is being handled by J. J. Henry & Co., New York marine architects, and the work is being carried out by the Alabama Dry Dock and Shipbuilding Co. Inc. at Mobile, Alabama, U.S.A.

Use in Britain

The marine terminal for the acceptance of the trial shipment in this country will be at Canvey Island on land belonging to the North Thames Gas Board and where there are suitable deep water facilities. The Board is undertaking special constructional work to receive the liquid methane and the two storage tanks necessary to deal with the trial shipment are now under construction. Each tank will have a capacity of about 1,000 tons of liquid methane. The contractors for this work on behalf of the Board are the Whessoe Company Limited of Darlington, and the Aluminium Plant and Vessel Company Limited of Crawley, and the design of the tanks has been determined by the Board in conjunction with these two firms.

The liquid natural gas will be pumped from the cargo tanks on the vessel to the shore storage tanks by specially designed ships' pumps through a pipeline with a 6 in. covering of insulation. Although these shore storage tanks are heavily insulated there will be a continuous boil-off of gaseous methane from the liquid and this material will be contained in a small gasholder of the dry-sealed Wiggins type, whence it will be pumped into the mains system. Liquid methane will be vaporized by heat exchange with water or steam and there is no intention at this stage of making use of the cold content or the refrigerating capacity of the methane. The liquid methane will be converted to gas under pressure and this pressure will be used to convey the gaseous methane into the Board's transmission lines. A new transmission line is being laid from Canvey Island to connect with a high-pressure main already in existence between Shellhaven and Romford Works and the gaseous methane will mix with refinery gases from the Shellhaven refinery.

The town's gas supplied in the North Thames Gas Board is distributed at 500 B.Th.U. per cu. ft. while the

methane has a calorific value of 1,000 B.Th.U. per cu. ft., and transformation of the methane into gas of 500 B.Th.U. per cu. ft. will be carried out at Romford by the Onia-Gegi catalytic process.

The gas after transformation will have similar characteristics to gas normally produced from coal and will be suitable in every way for consumers' appliances with the added advantage that it will be free from sulphur.

Citizens Clean Air Council Welcomed

The local authority would welcome a proposal to organize a West Bromwich Citizens Clean Air Council, Mr. Stanley Cayton, the town's chief public health inspector, said on 4th February. The proposal is being made by the committee of the householders objecting to the town's first Smoke Control Order. Mr. J. Higgins, chairman, said the proposal was to reconstitute the movement to give it wider scope.

Mr. Cayton said the aims of the proposed Citizens Clean Air Council were those of the local authority. "Apparently it is only in the method of achievement that we differ. The authority is anxious to co-operate with everyone concerned, but it is only through a Smoke Control Order that it can help financially," he added.

A public meeting held in Smethwick on 30th January at which G. W. Farquharson, Chief Smoke Inspector, Birmingham, and Hon. Secretary of the West Midlands Division, N.S.C.A., spoke on the implications of the Clean Air Act. A civic welcome was given by the Worshipful the Mayor of Smethwick, Alderman A. Harris, J.P., to which Alderman F. W. Perry, J.P., Chairman of the Smethwick Smoke Abatement Advisory Committee, replied. Mr. Farquharson's address created a very good discussion and the objectives of the meeting were emphasized by the presence of a particularly thick smog.

New Ceramic Coating for Pistons

A novel ceramic coating for piston heads which may help combat smog and air pollution by significantly reducing the amount of carbon monoxide and unburned hydrocarbons in exhaust gas has been developed by Armour Research Foundation.

The coating is also said to offer promise of greater combustion efficiency and, thus, more economical operation.

The new development stems from a previous Foundation patented technique called "Flame Ceramics," in which coatings are produced by spraying non-metallic powders through a flame gun. When such coatings showed signs of being able to reduce cracking due to heat and carbon deposits in diesel engines, the new development—a flame-sprayable coating containing rare earth oxides which would act as a catalyst in internal combustion engines—was undertaken.

In one evaluation test, a standard automobile engine, with coating applied to about half the top area of its pistons, was run under idling, cruising, and full acceleration and deceleration conditions with non-leaded petrol and with air bled in at the carburettor intake.

A comparison of exhaust data from this investigation with an identical "uncoated" engine test indicated that the coating decreased carbon monoxide and decreased unburned hydrocarbon proportion, particularly during acceleration and deceleration.

Although only a limited effect was achieved when the engine was operating under idling conditions or at high cruising speeds, the trial indicated that the coating might have a significant effect on engine exhaust gases which would probably be even more pronounced if both piston and cylinder heads were more completely coated with more active materials. Further research which is now being undertaken with regard to such matters as air-fuel mixtures and anti-knock and pre-ignition effects, should determine the full possibilities of the coating.

Low Cost Electric Heating

"Storage Heating Gives You Cheaper Heat from Off Peak Power" is the title of an eight page illustrated brochure, which explains why, for nearly all buildings, storage heating is the most economical method of electric space heating.

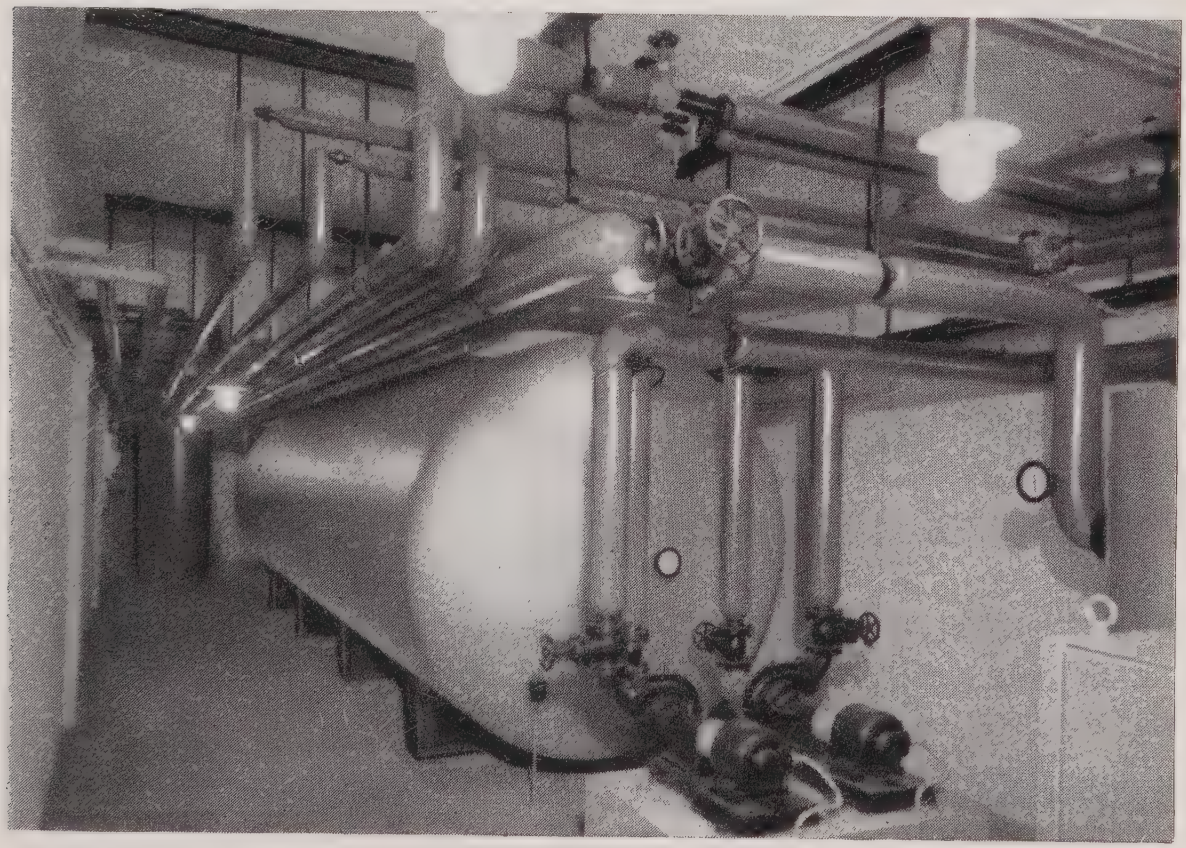
The system has the merit of using electricity when the demand for power is small (when the charge per unit is lower) and storing up this energy in the form of heat, to be released slowly during the hours when electricity is most in demand.

The three different storage systems are described in detail with the assistance of diagrams and photographs. All three are alike in principle, differing only in the medium used to store the heat. In the first, or unit type, blocks of concrete firebrick or similar material are used; in the floor warming system the substance of the floor itself takes the place of the storage blocks; hot water storage heating stores its heat in a large reservoir of water which is circulated through a conventional central heating system.

In all three systems, current is switched on automatically at a predetermined time (when the off peak charge is in force) and the temperature of the storage medium rises steadily; in the morning the current is switched off and the heating medium in cooling gives up to its surroundings the heat acquired during the charging period.

Storage heating provides the most economical and convenient method of heating shops, offices, showrooms, factories, flats and houses. The main advantages are that it requires no provision for fuel storage or ash handling, or for attendance. It should be noted that block storage heating is not available for domestic premises because of Purchase Tax regulations.

Copies of this brochure (E.D.A. 1811), which gives illustrations of actual installations, and examples of typical running costs in different types of buildings are obtainable from the showrooms of the Electricity Boards, or from the British Electrical Development Association at 2 Savoy Hill, London, W.C.2.



Boiler Room of a building heated by an electric water storage system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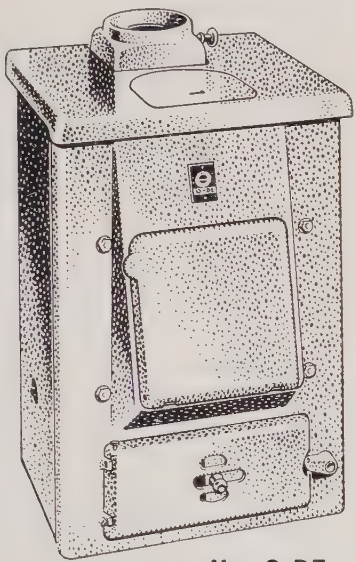

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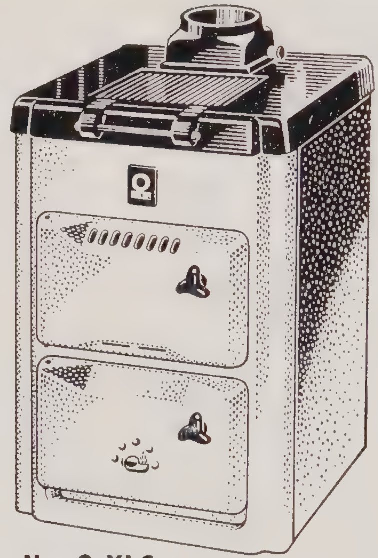

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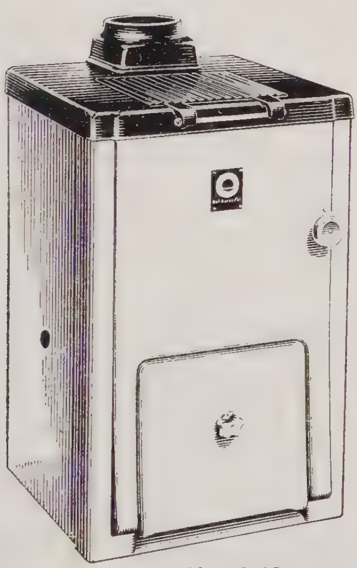
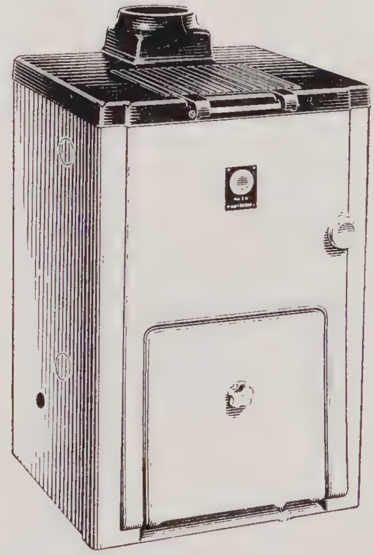


No. I 'Autocrat'



No. 2A 'Autocrat'

For over a quarter of a century, the name IDEAL has been a household word for all that is best in Domestic Boilers. This reputation has been built, and maintained, by unceasing research and the finest manufacturing skill in a field in which we may justly claim to be the pioneers. Our now famous Trade Mark, which appears on every **genuine** Ideal Boiler, is backed by the resources and unsurpassed experience of an organisation that is able to produce heating equipment of the highest quality at a remarkably low price. Thus this Trade Mark is recognised by members of the public as a guarantee of value, of the best in boilers that money can buy.

Recommend genuine **IDEAL** *Domestic Boilers*

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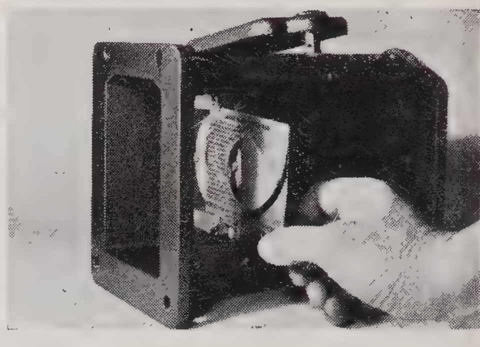
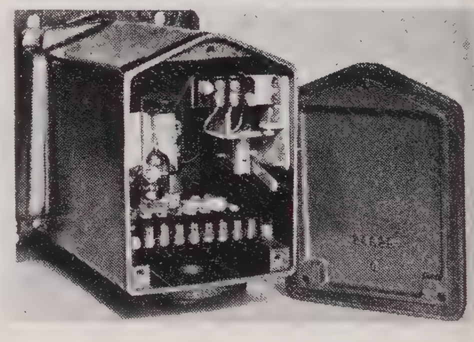
350 B

New Smoke Densitometer and Alarm complies fully with British Standards

The Clean Air Act of 1956 calls for limitation of the emission of dark smoke (No. 2 Ringelmann or darker). This new Lancashire Dynamo smoke densitometer and alarm is not only an economical alarm unit which will ensure compliance with the Act but, by the addition of an indicator or recorder unit, it becomes a smoke desitometer for better combustion control and lower fuel costs.



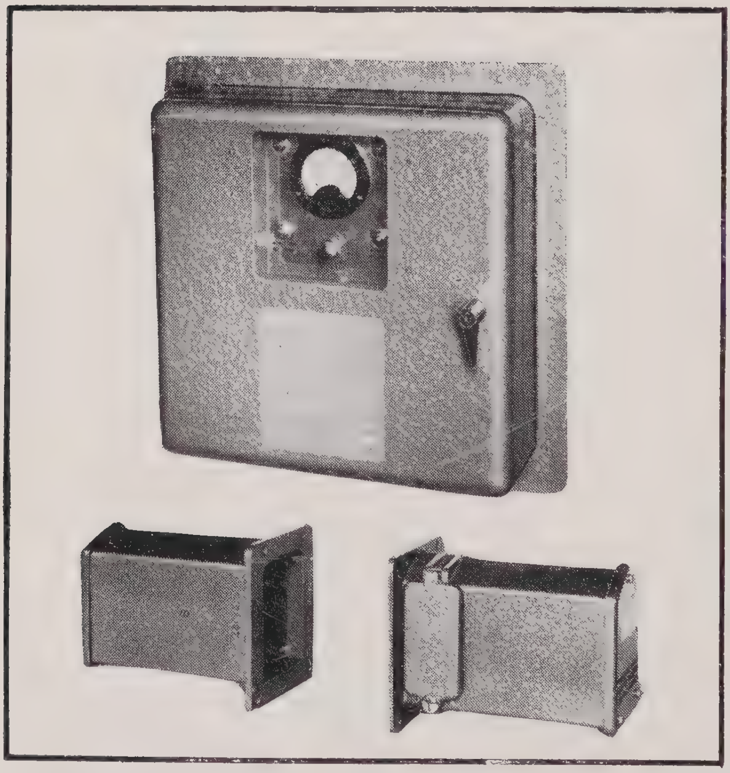
This equipment is the first of its kind to carry the British Standards Institutions 'Kite Mark', which indicates independent certification of compliance with BS.2740/56 or, plus the appropriate indicating instrument, with BS.2811/57.

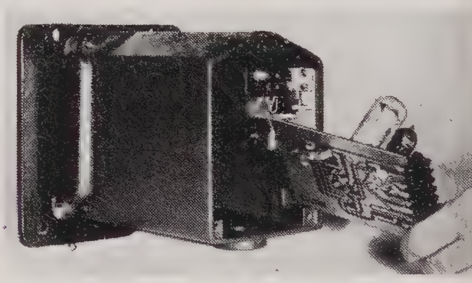


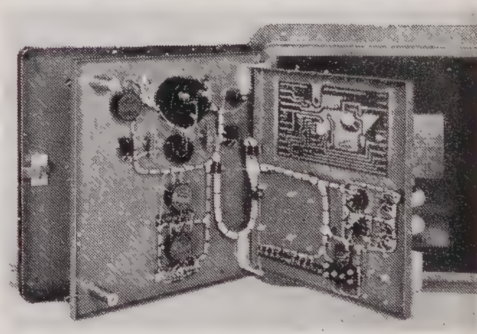
Note these Features

- **WEATHERPROOF CAST IRON HEAD UNITS WITH STAINLESS STEEL FITTING AND EASY ACCESS FOR LENS CLEANING.**
- **FULLY SERVO STABILISED LIGHT SOURCE PLUS "FAIL TO ALARM" CIRCUITS FOR CONSISTENT OPERATION.**
- **FULL RANGE OF ACCESSORIES INCLUDING CHIMNEY AND FLUE FITMENTS, INDICATORS, RECORDERS, ALARM BELLS AND HORNS, LENS CLEANING BLOWERS, SPECIAL CABLING AND MANY OTHERS.**

Calibration check by manual insertion of check slide or, in lower illustration of head with remote standardising unit, by push button from main unit.







Printed circuit in main unit and head for ruggedness. Head unit circuit easily removed without disturbing mounting of unit on stack.

LANCASHIRE DYNAMO ELECTRONIC PRODUCTS LTD

RUGELEY, STAFFORDSHIRE, ENGLAND

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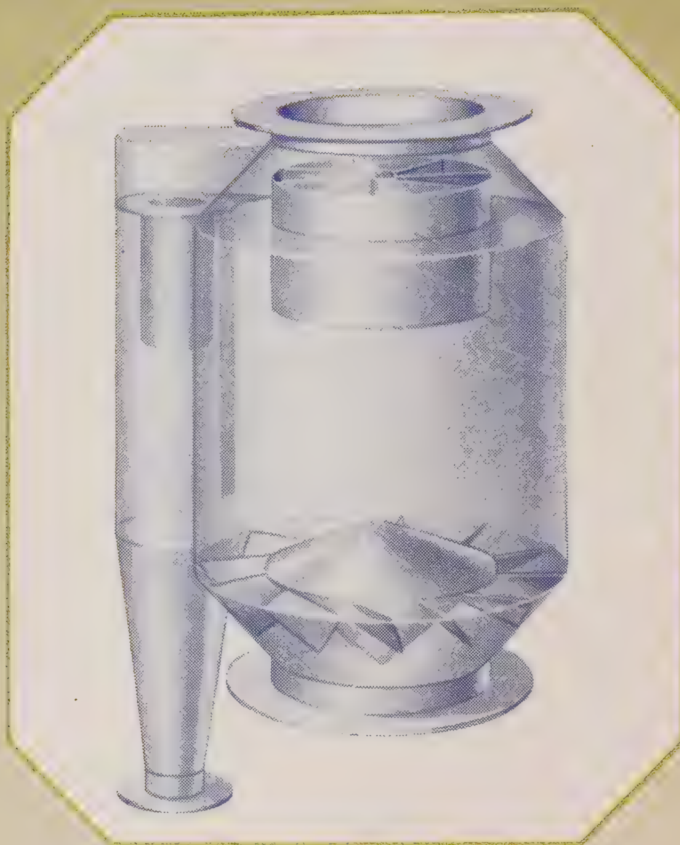
One of the Lancashire Dynamo Group of Companies

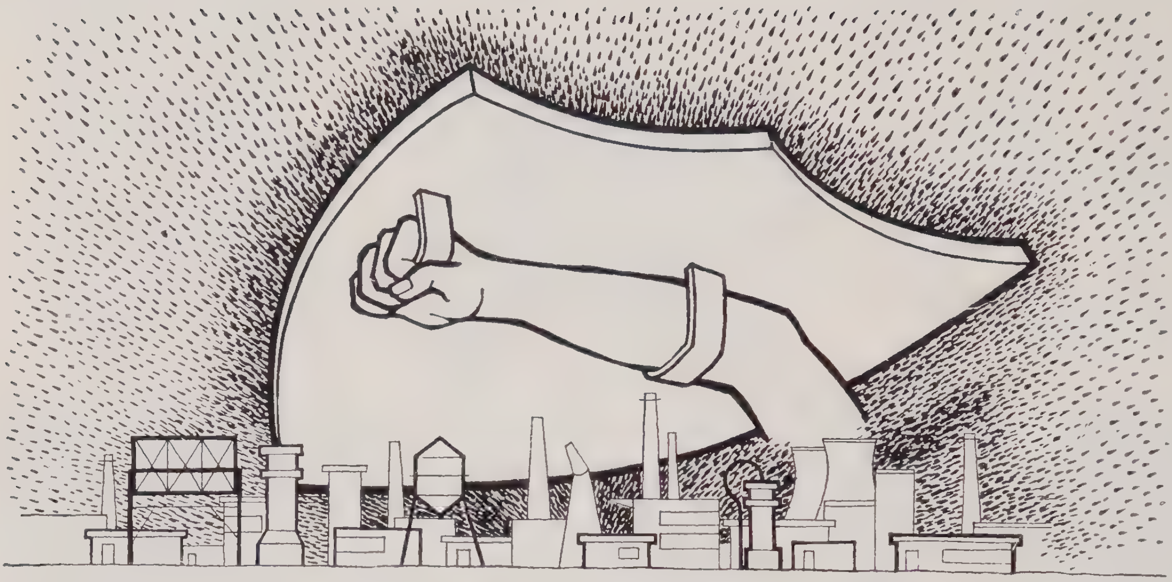


SMOKELESS AIR

JOURNAL OF THE
NATIONAL SOCIETY FOR CLEAN AIR

No. 106 ⋆ SUMMER 1958 ⋆ 2/-

In this Issue



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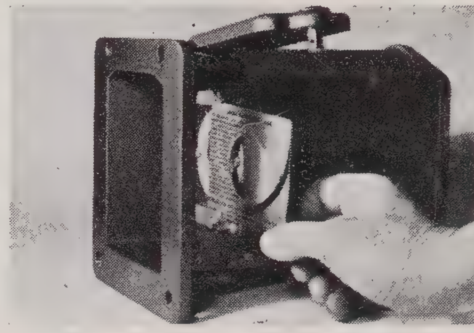

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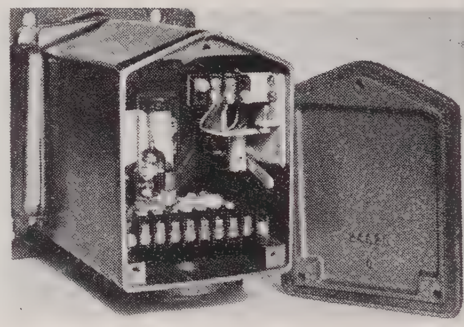

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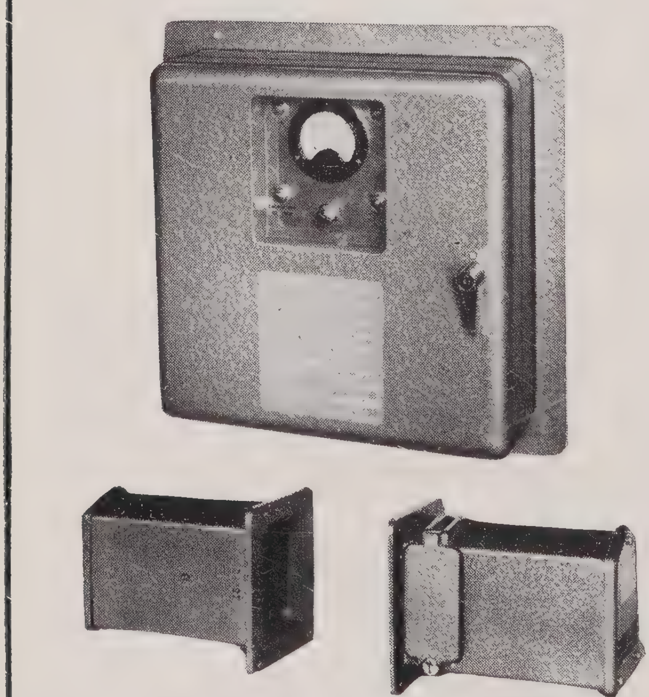

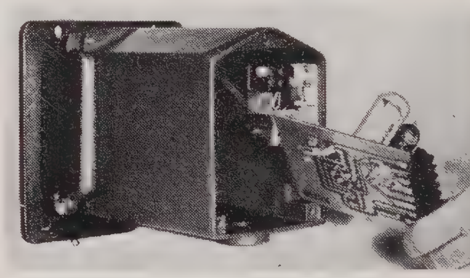

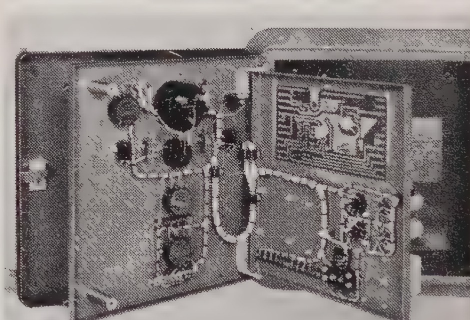

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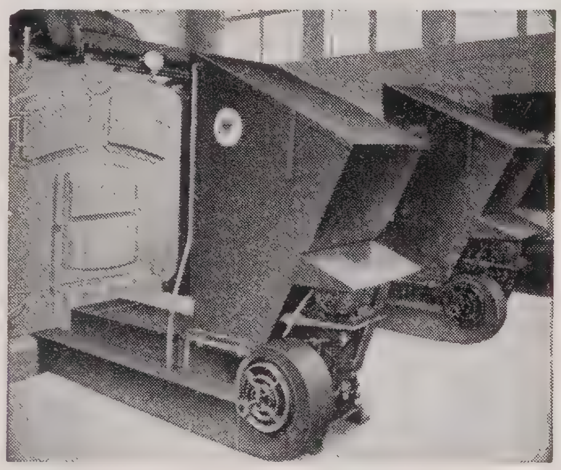
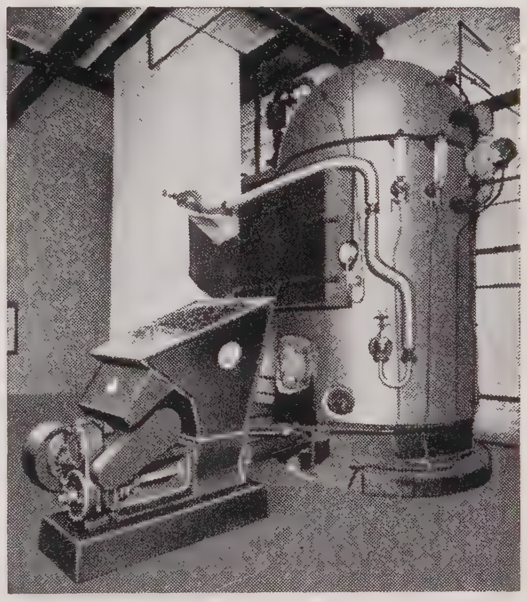
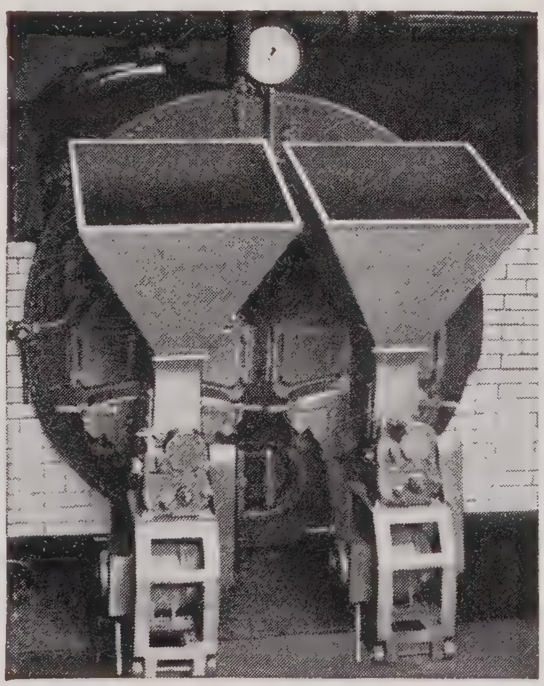


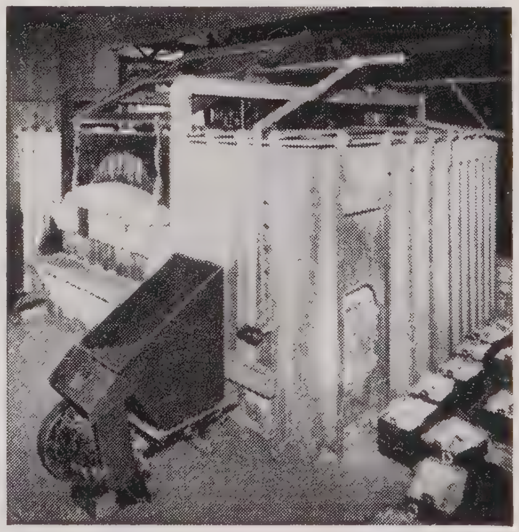
Stokers specially designed to withstand abrasion.



Vertical Steam-raising Boilers.



Shell Boiler Stokers.



Billet heating and Case Hardening Furnace.

National Society for Clean Air

CENTRAL OFFICES: Palace Chambers, Bridge St., London, S.W.1. (TRAfalgar 6838–9)

MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership applications form will be sent on request.

AIR POLLUTION NEWS

The Society's new Bulletin, published as required for the purpose of providing members and others with up-to-the-minute news of importance on all aspects of air pollution and the campaign for clean air.

APN will be sent free of charge to members and representatives of members *on request*, and to others on payment of postage account.

SMOKELESS AIR

Vol. XXVIII No. 106 Summer 1958

Principal Contents

Index to Advertisers

SMOKELESS AIR is published quarterly by the National Society for Clean Air at Palace Chambers, Bridge St., London, S.W.1. Tel.: TRAfalgar 6838–9 (Editorial and Advertising). Issued gratis to Members and Representatives of Members. Subscriptions rate for SMOKELESS AIR only, 8s. per annum, post free.

Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

Minister for Llandudno

ELSEWHERE in this issue we give more details about the Llandudno conference in October next, which we are now pleased to be able to announce will be opened with an address by the Rt. Hon. Henry Brooke, M.P., Minister of Housing and Local Government and Minister of Welsh Affairs. The Minister is of course also the Chairman of the Clean Air Council.

Diamond Jubilee

We are also able to make a preliminary announcement of an International Jubilee Conference and Exhibition to be held by the Society in London in October, 1959. 1959 is the sixtieth anniversary of the birth of the Society as the Coal Smoke Abatement Society, and thus of the beginning of the organized movement for clean air in this country. Although during the sixty years the Society has merged with its provincial counterpart and has twice changed its name, there is an unbroken line of members, officers and organization from those early days, when a very small group of enthusiasts met in the drawing-rooms of Dr. Des Voeux and Sir William Richmond. A few years later they had enlisted the interest and advice of the young scientist who is our present President. Thus although the name National Society for Clean Air is still less than six months old, we can very properly celebrate our Diamond Jubilee, and the important conference and exhibition now being arranged is the most fitting way in which this can be done.

Sir Hugh Beaver

We are happy to be able to report that, at the invitation of the Executive Council, Sir Hugh Beaver has consented to allow his name to go forward for nomination for election as the next President of the Society. The Presidential and Executive Council elections will be held by post during the summer, and the new President will take office from the Annual General Meeting at Llandudno, when Dr. Lessing's term of office comes to an end.

The Dark Smoke Regulations

The dark smoke regulations that are to come into force on 1st June are described on another page. They are notable for the eight hour observation period and the inclusion of a permitted limit for black smoke, even though this is not mentioned in the Clean Air Act and which is defined in the Regulations only as Smoke that appears to be as dark

as or darker than shade 4 on the Ringelmann Chart. We have so far had little comment from those who will be most directly concerned with the regulations, and it seems generally to be agreed that they deserve a good trial in actual practice.

Purchase Tax

The paragraph about purchase tax on gas and electric heating appliances in the last issue of this journal was quoted by Mr. Nabarro in the House of Commons, and in that way it was brought directly to the attention of the Chancellor of the Exchequer, and added to the weight of evidence that had led to the tax being halved. We wish that it had been abolished completely, and then also there would have been no occasion to begin to tax oil-heaters, even though it is fair enough that they should be on the same footing as their other smokeless competitors. Perhaps Mr. Nabarro will keep up the pressure and succeed in sweeping the whole lot away in the next budget.

Grit and Dust Control

Although the increase in initial allowances announced in the Budget will help all forms of industrial equipment, we regret that investment allowances have not been extended to include plant that will minimize the emission of grit and dust. A resolution urging such action was submitted from the Society, prior to the Budget, in the following terms:

" The Executive Council of the National Society for Clean Air notes the inevitable need to use progressively greater quantities of small and fine coal, which, by increasing the potential emission of grit and dust, will make it more difficult to meet the requirements of sections 5 to 9 (Grit and Dust from Furnaces) of the Clean Air Act, 1956.

" The Council therefore urges that all new or improved plant for the arrestment of grit and dust should be eligible for loans under the Fuel Economy Plant Order, 1956, or for investment allowance under the Income Tax Acts ".

Appointments

The appointment is announced of Mr. S. H. Clarke, C.B.E., M.S.C, HON. M.I.FIRE E., as Director of the new research station now being built for the Department of Scientific and Industrial Research at Stevenage for fuel and process research. Mr. Clarke is the present Director of the Fire Research Station at Boreham Wood, run jointly by the D.S.I.R. and the Fire Offices Committee. As is generally known, the new station will replace the present Fuel Research Station at Greenwich.

Mr. R. H. E. Thomas, O.B.E., Marketing Member of the National Coal Board, has succeeded Sir Henry Jones, M.B.E., Deputy Chairman of the Gas Council, as Chairman of the Solid Smokeless Fuels Federation. The election of Mr. Thomas was made possible by the N.C.B., as a whole, recently becoming a member of the Federation in place of its South-Western Division. The other members of the S.S.F.F. are the Gas Council, the British Coking Industry Association and the Low Temperature Coal Distillers' Association.

Mr. Thomas Johnston, C.H., LL.D., J.P., F.E.I.S., Chairman of the North of Scotland Hydro-Electric Board has been appointed President of the British Electrical Development Association in succession to Viscount Chan dos.

Purpose and Needs

The Society is about to issue a new booklet to help it in appealing, urgently, for more funds. The position is serious, not because membership and subscriptions are falling off, but because so much more is either being done or is waiting to be done. An appeal for support must be justified, and the booklet starts off by giving reasons—cogent ones, we believe—why the Society can and should " continue to lead

the campaign within its own recognized field ". Briefly, it can be effective because of its history, independence, membership, and its long and intimate collective knowledge of the problem. One point that may be of interest because it is usually assumed and not stated, may be quoted: " All that it says and does is known to be on behalf of clean air, and clean air alone, and for this reason it can often be more effective and convincing than those whose interests are not solely for clean air. Similarly, because it is a voluntary and independent organization, its words may be more acceptable to many than if they came from 'official' sources, at either national or local level ".

A Double Problem

The booklet explains how the Society is faced with two problems—first, how to cope with all the demands already being made for its services, and secondly how to seize the opportunities that now present themselves for extending and developing these services and providing new ones in the way that is necessary if the campaign is to be successful. For the first and most pressing stage, the need is to increase the present income to £20,000. For the second stage, " for a campaign of the kind that is really required, an income of at least £50,000 a year is necessary. This is the lower limit for what might be called a national campaign, directed largely to the general public, and experience might well show that even larger sums would be needed, even if only for a few years ". The immediate expenditure requirements are analysed—for publicity and display material; education and information material; information, library and advisory services; press publicity; investigations; and conferences and meetings—adding up to more than £10,000 a year additional income.

In conclusion, the appeal points out that " the financial position would be improved if membership could be very substantially increased. But this would take time and divert effort and money from the more urgent work that has been indicated. The alternative is to appeal for contributions that are substantially above the purposely modest minimum membership rates ". The appeal is therefore directed, less to individuals than to local authorities, firms and associations. Four ways of responding are suggested: to double present contributions, to become Sustaining Members at £100 or more a year, to contribute even larger sums for if necessary a fixed period of three or five years, or " to make a single generous donation ".

Copies of this booklet will be gladly sent to any reader who would put the Society's case before his own authority or organization, or who can bring it to the notice of others who might be prevailed upon to loosen their purse strings.

Stop Press

A fortunate gap on this page enables us, as this issue is being proofed and made up for printing, to mention briefly the remarkable burst of publicity for clean air which occured on and around 1st June, when the remaining sections of the Clean Air Act came into force. Reference may also be made to the issue of the regulations that give the permitted periods of dark smoke emission from ships, and to the publication by the Ministry of Housing and Local Government of a " Memorandum on the Industrial Provisions " of the Act. These will be recorded more fully in our next number.

Also too late for a full report this time is the annual conference of the Scottish Division of the Society in Glasgow on 23rd and 24th May. For our Autumn number, too, there should be further details available on the preparations for the Diamond Jubilee International Conference and Exhibition mentioned earlier in these notes. We can now, however, state the date and place: Tuesday, 20th, to Friday, 23rd October, 1959, at the Seymour Hall, London, W.1.

THE DARK SMOKE REGULATIONS

Inclusion of Black Smoke

THE Regulations relating to dark smoke control, as required by section 1 of the Clean Air Act, were laid before Parliament on 27th March as " The Dark Smoke (Permitted Periods) Regulations, 1958 " (S.I., 498, 1958). The effect is that from 1st June, 1958, it will be an offence for dark smoke to be emitted from any chimney for a period longer than that permitted under the regulations. The basic period is ten minutes in any period of eight hours, but there are variations according to the number of furnaces leading into one chimney and whether soot-blowing was carried out during the period. The position may be set out as follows, the regulations permitting:

(i) Not more than 10 minutes dark smoke emission in the aggregate from any chimney in any period of eight hours.

(ii) This permitted time to be extended to 14 minutes if soot-blowing is carried out within the eight hour period.

(iii) The 10 and 14 minutes to be extended for chimneys serving more than one furnace, as follows:

A chimney serving:

2 furnaces, 18 and 25 minutes, respectively;

3 furnaces, 24 and 34 minutes, respectively;

4 or more furnaces, 29 and 41 minutes, respectively.

(iv) A continuous emission of dark smoke, other than that caused by soot-blowing, for a period of not exceeding four minutes.

(v) The emission of black smoke up to two minutes in the aggregate in any period of 30 minutes.

Black Smoke

It will be noted that (v) above makes it an offence to emit black smoke in excess of the permitted limit. Under the Public Health Act of 1936 (initially the Public Health (Smoke Abatement) Act, 1926), provision was made for the control of black smoke through byelaws. Many local authorities secured byelaws under which the emission of more than two minutes (in some cases, three minutes) black smoke in any period of 30 minutes constituted a statutory nuisance. There is no reference to black smoke in the Clean Air Act, and during its passage as a Bill through Parliament it was pointed out that this was a step backwards. The new regulations remedy this defect by defining black smoke as that which is as dark or darker than Ringelmann No. 4, and by restoring the former time limit.

Ships

The regulations apply to all chimneys, including those of railway engines, but not to the funnels of vessels. Separate regulations for ships were not issued until the end of May and are mentioned briefly on page 235.

The Scheduled Processes

The Alkali &c. Works Order, 1958 (S.I., 497, 1958), which has also been laid before Parliament, extends the list of Works which are scheduled under the Alkali &c., Works Regulation Act, 1906, and the List of Noxious or Offensive Gases contained in it. With a few modifications, the schedules are as published in this journal, Spring, 1958, pages 166–168.

The effect of the Order is that the processes and operations scheduled will be normally controlled under the Alkali Act instead of the Clean Air Act, and by the Government's Alkali Inspectorate rather than by the local authorities.

There have been suggestions that this is not necessarily the case, because of the second paragraph of section 17(1)

of the Clean Air Act, which is to the effect that the scheduling of processes for control under the Alkali Act does not affect the control by local authorities of smoke, grit and dust and smoke nuisances (sections 1, 5 and 16) of such processes, but that no proceedings shall be brought in any such case except by the consent of the Minister. This consent, we take it, would be given only if for some reason the Alkali Inspectorate was unable to carry out its duties in any area, and that the situation would therefore be most exceptional. It is true that the consent of the Minister would have to be sought only when proceedings were proposed and that it would appear to be possible for local authorities to make observations and representations. This, however, does not seem to constitute " control."

THE INVESTIGATION OF AIR POLLUTION

New Annual Report

THE D.S.I.R., thanks to the efforts of those in charge of the work at the Fuel Research Station, is continuing to catch up with the arrears of reports, and there has now been published the 29th Report of the Investigation of Atmospheric Pollution, for the year ended 31st March, 1956. (H.M.S.O., 7s. net.)

It is not easy to review the report, both because for obvious reasons it has nothing remarkable to record, and because the large number of observations now being taken make it impossible to do other than mention them in general terms. In earlier days it was possible for this journal to give, on a single page, a list of stations with their total deposit figures for the year—a possibly risky practice, anyhow, for it could tempt the unwary into making erroneous comparisons.

The new report shows a further rise in the number of co-operating bodies and in the number of instruments in use. The latter increased by 391 to a total of 2,113, divided as follows:

Deposit gauges	892
Smoke filters—	
—daily	162
—automatic	7
Sulphur dioxide—	
—volumetric	117
—lead peroxide	935

The report notes with appreciation that the number of smoke filters has been increased by about 50 per cent. over the previous year and the daily sulphur instruments by over 80 per cent. There is still very considerable room for increasing the numbers of these instruments, the value of which is much greater than that of the monthly deposit gauges and lead peroxide candles.

It is interesting to note that whereas in the past practically all the instruments were being used by local authorities, in 1955–6 they were responsible for only 70 per cent. 25 per cent. were being operated by nationalized industries and 5 per cent. by private firms, hospitals, Government departments and the like.

The summary tables show little change over the previous year. There is a slight increase in the smoke filter measurements, but this is without significance because of the increased number of instruments in use, many of which are in the London area.

The highest and lowest smoke and sulphur dioxide figures are of interest because they emphasize so clearly the enormous difference between what is and what might be. Thus for smoke during the winter months the average concentration for the six stations at the top of the list is 81, for 164 average stations the figure is 32, and for the

eight lowest, or cleanest, stations it is three. In other words, the average is over 10 times as " dirty " as the clean, and for the really black spots the ratio is 17:1. During the summer months the ratios are even wider, being 31:12:1. For sulphur dioxide (by the volumetric method) the high, average and low values are closer, being 19:11:3 for the winter and 10:5:2 for the summer.

Smog Tests

The volume contains the reports of the Standing Conference of Co-operating Bodies and the Atmospheric Pollution Research Committee, together with an account of other work of the Fuel Research Station on the abatement of air pollution. These reports contain much material of interest. Thus Mr. C. J. Regan, as Chairman of the Atmospheric Pollution Research Committee reports on the rapid tests arranged for and carried out during periods of smog:

" It will be recalled that the Committee on Air Pollution and the Clean Air Act had their origins in the public outcry that followed the increased death rate among bronchitics and others suffering from respiratory diseases during and immediately after the fog that covered London for a week in 1952. Measurements made at the time showed that the average concentration of several pollutants were abnormally high and it was clear that a detailed investigation was necessary. As described in the last Report, tests were perfected that could be used by relatively unskilled patrols during fog and several hundred volunteers were trained for the work. An opportunity came to put the scheme into operation when several days of dense fog occurred in January, 1956; some thousands of measurements were made in London, Birmingham, Leeds, Manchester, Salford and Sheffield. We would like to thank the volunteers who made these measurements under such unpleasant conditions and to assure them of the great value of their work. Statistical analysis of the data has indicated that there is a correlation between the concentration of smoke in several areas of London and the increased mortality, but no definite correlation between mortality and sulphur dioxide has so far been found. More extensive investigations are required before precise conclusions can be drawn on the effect of individual pollutants or combinations of them on health."

Block Heating Test at Leicester

Special permission has been given by the Customs and Excise Department for the first experiment in the country with block electric heaters for domestic premises to be carried out in Leicester.

Permission is needed because these heaters are free of purchase tax and at present are used only for industrial and commercial premises at off-peak power load periods.

The experiment will be carried out with the co-operation of Leicester Housing Committee in 16 houses which are being built in the slum-cleared Wharf-street area which is to be Leicester's first smoke control area. Installation costs and part of the running costs will be shared by the National Electricity Council and the East Midlands Electricity Board. The results will be carefully recorded over a period by special meters and instruments and the tenants will have to agree to the test being made.

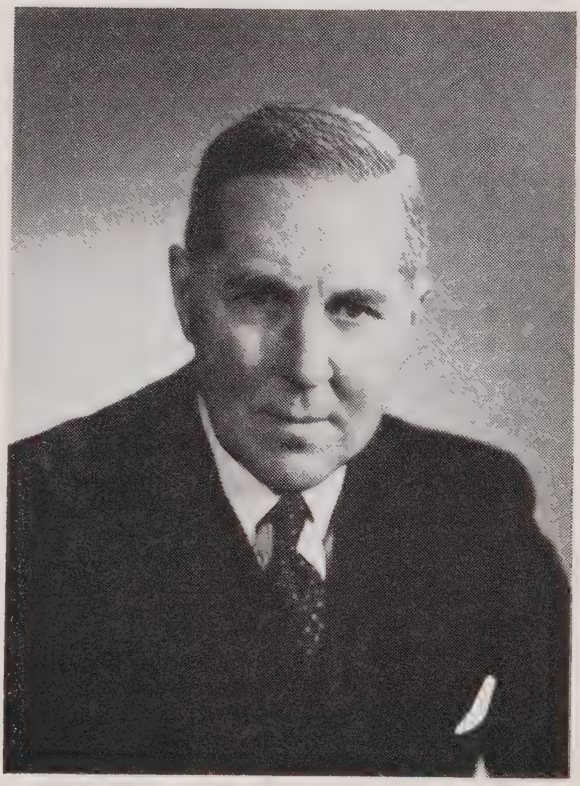
Conventional fireplaces will be built into the houses so that tenants, if they wish, can change over at the end of the experiment to the use of approved solid fuel. A block heater will be fitted into the living room, another in the kitchen and one in the hall. The cavity walls will be insulated with fibre glass and double-glazed windows will be installed as a further measure to conserve the heat.

The Llandudno Conference

— and Exhibition!

THE programme of the 1958 conference of the Society, at Llandudno on 1st to 3rd October, has now been completed and invitations are going out. As mentioned in the editorial notes, the conference will have the privilege of an address from the Rt. Hon. Henry Brooke, M.P. As Minister of Housing and Local Government, as Minister of Welsh Affairs, and as Chairman of the Clean Air Council, Mr. Brooke can be assured of a special welcome from a conference called to North Wales to discuss clean air.

The conference will open on the Wednesday morning with a welcome from the Chairman of the Llandudno Urban District Council, after which the Minister will speak, and the session will end with the second Presidential Address by Dr. R. Lessing.



The Rt. Hon. Henry Brooke, M.P.

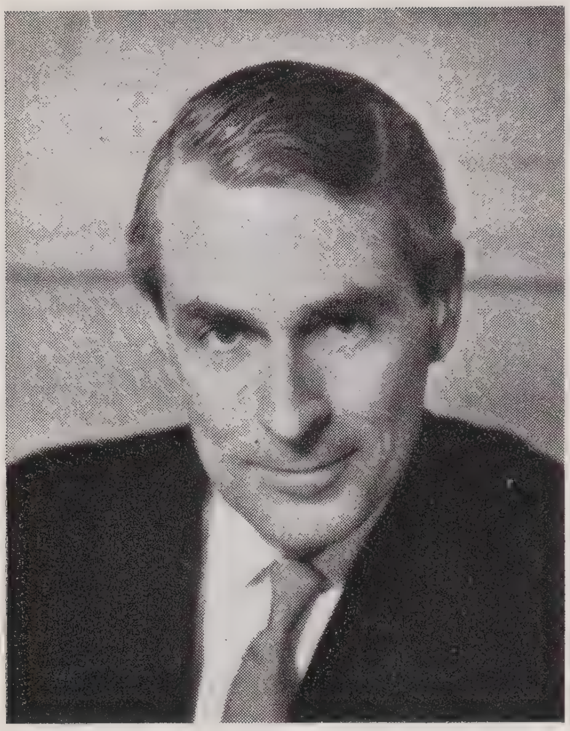
The Exhibition

The session is being timed to finish early, to allow all delegates a perhaps first opportunity of inspecting the Exhibition that, for the first time, the Society is arranging in conjunction with its conference. This will be be staged in the gallery of the Pier Pavilion, where the meetings are to be held. All the stands—offered only to members of the Society and advertisers in this journal—have already been booked, and it can be said that the exhibition will be first-class in what is to be shown.

On the Wednesday afternoon some of the more important aspects of the industrial sections of the Clean Air Act will be discussed. Papers will be presented on dark smoke and its control by George W. Farquharson, on grit and dust control by Thomas M. Ashford, and on the height of chimneys by Norman Bastable. It hardly seems necessary to introduce these speakers, but for the minority who may not know them, they are, respectively, the Chief Smoke Inspectors of Birmingham and Glasgow, and the C.P.H.I. of Barking.

Thursday morning will see a rather different kind of session. It will be a " Forum on Smoke Control Areas ". A situation report has been invited from each of the Society's Divisions, and these will be pre-printed and distributed before the conference with the other papers. They will not be introduced separately, but will be reviewed by Professor Llewelyn Roberts, M.O.H. for Sheffield acting as a rapporteur. With him on the platform will be the Divisional representatives and a small group of technical people to answer the questions that will be invited from the meeting during a free-for-all discussion.

In the afternoon some rather more scientific aspects of air polution will



Sir William Holford

be the theme. The authors will be Dr. Wilkins of the Fuel Research Station on a special survey of pollution in the London area; Dr. D. D. Reid, of the London School of Hygiene and Tropical Medicine, on recent investigations into the health aspects of the problem, and D. V. Brook and Dr. S. A. Burke, of B.C.U.R.A., on a new type of miniature chain-grate stoker.

The conference will end on the Friday morning with the Des Voeux Memorial Lecture, to be given this year by Professor Sir William Holford, of the University of London, whose subject will be " Clean Air in Relation to Urban Amenity and the Growth of Towns ". The Society's A.G.M. will conclude the proceedings.

There will also be a reception for delegates by the Chairman of the Urban District on the Wednesday evening, while the popular informal " get together " will be held on the Tuesday evening, September 30th, at the headquarters hotel, the Queen's (adjoining the Pier Pavilion). Delegates who wish to stay at this hotel are advised to book early.

Some Publications Received

The *Steam Engineer*, one of the publications of John D. Troup Ltd., has recently appeared with attractive changes in styling and typography, and a redesigned cover. Equally good-looking, too, is the monthly *Heating*, from the same firm, which is *The Industrial Heating Engineer* under a more comprehensive title. It is largely concerned with space heating, and much of its contents are of direct clean air interest—articles on the development of district heating in Russia, on the South Kensington District Heating scheme, and on thermal insulation of industrial buildings. On the domestic side there is an article on floor heating by electrically heated underlay.

Many readers will have secured the excellent supplement on Clean Air published last year by the *Leeds Journal*, of the Leeds Incorporated Chamber of Commerce. This has now been followed up by a twelve page supplement to the *Journal* entitled *A Short Guide to Clean Air*. It is designed to provide guidance on the implications of the Act for industry and commerce. In addition to outlining the provisions of the Act the booklet gives some useful technical and fuel efficiency information.

The Solid Smokeless Fuels Federation have issued their annual report for 1957 in duplicated form. It outlines the considerable amount of activity being carried out by the Federation, including its publicity work in exhibitions and by means of publications for the promotion of clean air.

The Gas Cleaning Division of W. C. Holmes & Co. Ltd., of Huddersfield, have issued a well-illustrated and informative brochure on the Holmes-Elex Electrical Precipitators.

THE PROBLEM OF SMALL COAL

A Recent Conference

WITHOUT a progressive mechanization in the mines coal output could not have been kept up during the past decade. Mechanization brings with it a larger proportion of small coal, as does the increased use of explosives that has also been necessary. Although there has been an increased demand for small coal the supply is tending to outpace requirements, and the National Coal Board is faced with a growing problem of how to dispose of what it is estimated may be an annual surplus of 5 million tons a year by 1965. Conversely, there is the problem arising from a decreasing proportion of large coal.

Because of this the Board suggested to the Institute of Fuel that it should hold a conference on "The Use of Small Coal—Today and Tomorrow." This was arranged and held in London on 5th and 6th May. The chairman of the conference and of its organizing committee was Mr. John Rylands, who many of our readers will remember for his contribution at the Society's conference at Hastings last year. As he emphasized, the purpose of the conference was to discuss the small coal problem from the technological viewpoint, and not to become involved in discussing the easy—but perhaps not very helpful—answer: reduce the price.

An opening address was given by Sir James Bowman, Chairman of the N.C.B., who pointed out that ten years ago one-third of the coal output was large, and that now it is only one-quarter. The question was how to decrease the demand for large and increase that for small. The conference would, he said "be considering the use of a national asset which forms —and will increasingly form—an integral part of the country's energy budget. We cannot afford, and it will certainly not be in the consumer's interest, to waste it, for you may look upon it that much of the return from our investment in the industry's massive reconstruction programme will be in the form of smaller sizes of coal."

The main paper, printed in advance, was by Mr. R. J. Moffat, Director-General, Marketing, of the Board, on the nature and scope of the problem. Other speakers dealt with distribution, the use of smalls—present and future —in electricity generation, the coking industry, general industry, and finally about the successful use of slurry by the Coal Board itself and in a generating station in Scotland specially designed for this purpose.

As the Society's resolution, quoted in our editorial comments, shows, this increasing need to use small coal is of concern to the clean air movement, because of the way in which it can, unless care is taken, add to the problems of grit and dust pollution. Here we may quote from Mr. Moffat's very informative paper:

"Improved fuel efficiency can certainly help to solve some of the problems which are arising from the increase in the proportion of small coal, both by assisting users to change to smaller sized fuels while maintaining or improving their present efficiencies and perhaps—just as important a matter—by improving the efficiency of use of large coal where such fuel is necessary. It may be a fact that on the whole the most inefficient users of fuel are to be found among those using large coal.

"In relation to the Clean Air Act, smalls fired in a variety of mechanical appliances can certainly be burnt smokelessly, that is to say, in such a way as to comply with Section 1 of the Act, though different appliances require different fuels, and all need reasonable consistency in supply. The obligation to avoid grit and dust emission, however, may mean that

extra capital cost may be required, which does not of itself add to efficiency in use.

"It has been said that one consequence of progress in implementation of the Clean Air Act will be the progressive elimination of hand-fired boiler plant. In so far as this leads to the elimination of the use of large coal, it is a development to be welcomed. Other smaller sizes of coal can meet the demand and secure compliance with the provisions of the Clean Air Act if they are used in mechanical-firing equipment properly installed, maintained and instrumented."

Small Coal and Smokeless Fuel

Another aspect of the problem, of clean air concern, that was discussed at the conference, was the use of small coal to produce smokeless fuel. Dr. Idris Jones gave an outline of the important work in progress at the Coal Board's Research Establishment at Stoke Orchard, under the direction of Dr. Bronowski. The processes being investigated and in some cases developed, are most important and we hope to report them in detail when the text of Dr. Jones's contribution is available.

He was followed by Dr. James Burns, President of the Institution of Gas Engineers, on the use of small coal in his industry. He outlined possible future uses by new processes for the total gasification of coal. Among these is the Lurgi process, the development of which in Scotland is reviewed on another page. Dr. Burns spoke of the hope the industry had of increasing the calorific value of gas, and his remarks showed the growing trend towards gas at the expense of coke production. As suggested in the case of the Scottish plant, complete gasification of small coal might make it possible to produce more, and better, solid fuel from plant continuing to carbonize suitable coals with this as the primary purpose. But nevertheless the future pattern for solid smokeless fuel remains uncertain. There might be less coke of higher quality from the gas industry, and more—much more, we hope—from the new processes being developed at Stoke Orchard. Whatever the final pattern may be, however, it is clear that the clean air programme is linked closely with the technological changes that are either being sought, or cannot be avoided, in the coal industry. For these reasons, as well as because of the grit problem that may be aggravated by small coal and fines, it is necessary for the Society to be watchfully interested in all that is happening.

Smokeless Zone, Heraldic

The City of Manchester has recently been granted and assigned a "Device or Badge," which for the first time in heraldry, as far as we are aware, includes a symbol of clean air. The Badge, illustrated above, is described as *An Eagle displayed Wings inverted Or the tail feathers enfiled by a Mural Crown Argent the claws grasping the said Crown and charged upon the breast with a Fesse dancetty of two points Gules within an Annulet of the same.*

The Mural Crown Argent, or the silver stonework, which should glisten white and clean, is declared to symbolize two things prized by Manchester—her long association with cotton and the lead she has given by being the first city in the Kingdom to seek for and obtain legal powers to create smokeless zones.

HYDRO-ELECTRIC PROGRESS IN SCOTLAND

Report for 1957

Tummel Garry Scheme—Pitlochry Dam and Power Station

THE report is an illuminating document regarding progress from modest beginnings in 1944 to a stage where electricity is supplied to 85 per cent. of the households and 55 per cent. of the farms in the Board's area. Over 80 per cent. of the electricity is generated by water power, naturally with no resulting atmospheric pollution.

It may be convenient to recall that the North of Scotland Hydro-electric Board, as its title indicates, was established to develop the hydro-electric resources of its area; but that by the Electricity Act of 1947, it was commissioned to take over the municipal and privately owned generating plants in its area.

The hydro-electric plant is 730,000 kilowatts. During the year 103,000 kilowatts of generating plant was brought into commission of which 30,000 kilowatts was steam plant. It is interesting to note that a plant at Altnabreac in Caithness to be started up this year, will be driven by a peat-fired gas turbine.

The maximum demand on the Board's mainland interconnected system was 411,000 kilowatts in December. The islands and areas with

independent generation accounted for an additional 20,000 kilowatts. The island of Iona has been connected to the distribution system of the Isle of Mull by a submarine cable.

During 1957 the Board exported 466 million units to the South of Scotland Board and bought 72 million units from the South at off peak. The mainland grid extends to 1,500 circuit miles.

The capital expenditure to date amounts to £176 million, of which hydro-electric plant accounts for £121 million, steam and diesel plant for £5·5 million, transmission lines £14 million and distribution £14 million.

The total revenue for the year amounted to £11,800,000 and the surplus for the year—adversely affected to the extent of £198,000 by the rise in the bank rate—was £359. The accumulated deficit amounts to £612,000.

The Board has endeavoured to attract new industries to Scotland and its efforts have been rewarded by the establishment of industries specializing in water turbine and generating plant, and at Inverness two firms have started the manufacture of small rural transformers and other electrical equipment.

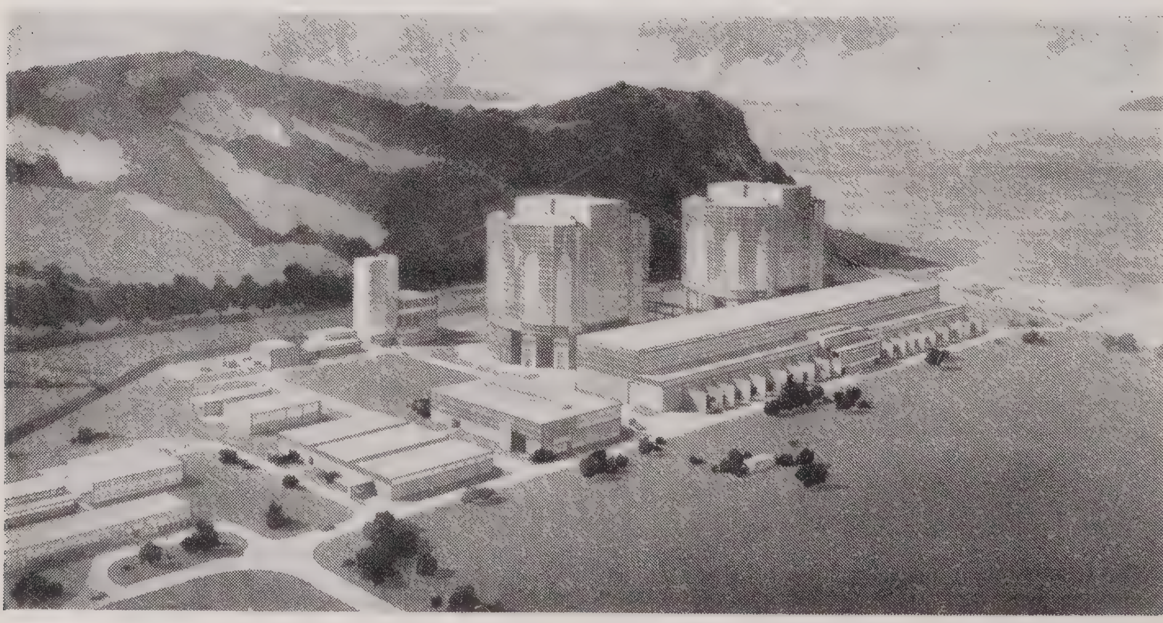
ELECTRICITY IN THE SOUTH OF SCOTLAND

The third annual report of the South of Scotland Electricity Board for the year ending 31st December, 1957: including the report of the Electricity Consultative Council. (H.M.S.O., 4s.)

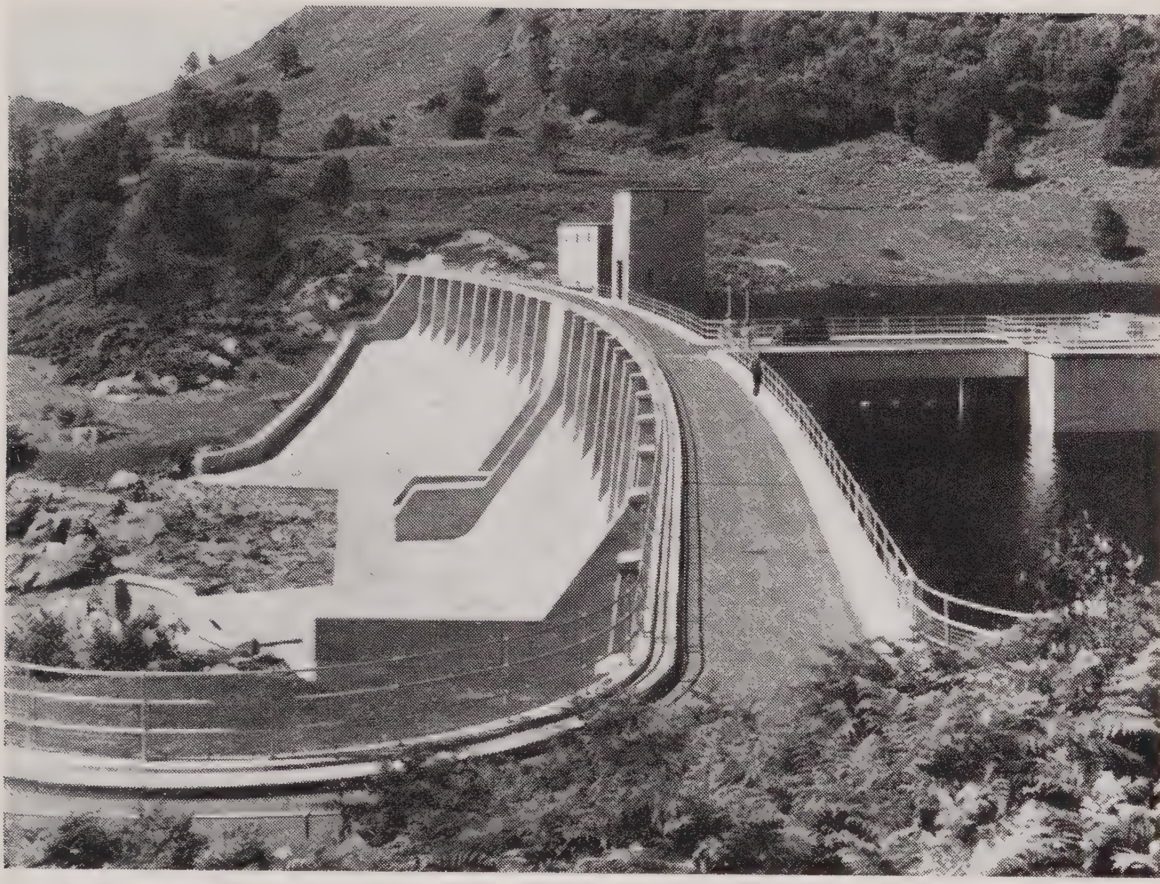
The South of Scotland Electricity Board came into being under the provisions of the Electricity Reorganization (Scotland) Act 1954, and the third annual report shows the progressive development of the Board's undertaking.

The installed generating capacity amount to 1,489,145 kw., with output capacity of 1,374,000 kw. of which 1,252,000 kw. is furnished by steam plant and 122,000 by the Galloway and Lanarkshire hydro-electric schemes. During the year 102,500 kw. of new steam plant was commissioned and 500 kw. of obsolete plant was shut down. It is interesting to note that the new station at Barony of 60,000 kw. is the only one in Great Britain to be fired with washery slurry.

The expansion programme up to 1965 envisages the installation of a further 1,570,000 of output capacity



Artist's impression of the Hunterston Nuclear Generation Station of the South of Scotland Electricity Board



The Conon Valley Hydro-electric Scheme—the Loch Luichart dam

including 300,000 kw. from the projected nuclear power station at Hunterston. The new station at Kincardine when completed will have an installed capacity of 760,000 kw.

The overall thermal efficiency of generation was 25·94 per cent. compared with 25·04 per cent. in 1956. The most efficient plant was the high pressure station at Portobello with an efficiency of 30·68 per cent.

5,562 million units were sold to consumers, who at the end of the year numbered 1,296,650, an increase of 30,291 during the year. Electricity is now supplied to 12,863 farms, 80 per cent. of the farms in the Board's area. The average price per unit sold was 1·468d. as compared with 1·449d. for 1956. The maximum demand, on 10th December, 1957, amounted to 1,518,000 kw. The excess over the Board's output was met by import from the North of Scotland.

The stations of the Board consumed 2,744,335 tons of coal and 69,006 tons of coke breeze, at an average adjusted price of 91s. 8d. per ton.

All non-standard A.C. and D.C. consumers have been changed over to standard A.C. supplies. Extension of the 275,000 volt super grid and the 132,000 volt transmission system is in progress.

The requirements of the North of Northumberland are met by the Board and Holy Island is now connected to the system.

The Board continues to foster the development of off-peak loads and at the end of the year had supplies of 124,606 kw. connected for services as varied as space heating of buildings, arc and induction furnaces, tar heating, drying of grass and grain crops, as well as floor-heating in domestic flats.

The trading income of the Board amounted to £34·4 million, yielding a surplus of £517,872. £19·24 million was expended on capital account. The Board paid £1·43 million in rates to local authorities.

THE RINGELMANN CHART

Standard Published

AFTER the better part of a century the Ringelmann Chart has arrived officially in this country, although it has been printed and available for many years from the firm of Charles Griffin & Co. Ltd. Because of its inherent limitations and the practical difficulties of using it, the chart never found wide favour here—in contrast with the U.S.A.—until its use was recommended by the Beaver Committee and it was legally recognized in the Clean Air Act.

The British Standards Institute has now issued a " standard " chart and a booklet of notes on its use. The chart (B.S.2742 C.) is available at 3s. per copy, or 5s. with postage and packing. The booklet, " Use of the Ringelmann Chart " costs 2s. 6d. The text consists of two pages of explanation and advice. There is also a page diagram showing how to make a metal holder for the chart, and a half-page sketch showing how to stand the chart when observing a chimney. It seems somewhat expensive.

The chart, as is now generally known, gives varying shades of grey (when viewed from a sufficient distance) by means of a criss-cross of black lines of differing thickness on a white ground, so that a transition from white to black is made by stages, each of which increases the degree of darkness by 20 per cent. Ideally, the chart should be printed with 100 per cent. black ink on 100 per cent. white paper. That is, the luminance factor of the paper should be 100 per cent. and that of the ink *nil*. The B.S. notes state that the commercially-printed charts, including that issued by the U.S. Bureau of Standards, are printed on a paper with a luminance factor of about 80 per cent. and with ink of a luminance factor of about 5 per cent. The B.S. standard chart, it is stated " has been so printed as to reproduce with consistency shades of grey which are near the average of those to which users are accustomed."

In other words, the standard chart is similar to the familiar Griffin edition, which is thus recognized as meeting the standard requirements. The main difference between the two charts is that the B.S. is printed on stiff card, while the Griffin is on paper. (The latter costs 7s. 2d. per dozen, including postage and notes for use.) The B.S. includes the No. 0 shade, or 100 per cent. white. This, it is said, provides a useful indication of the illumination and helps to show when the chart is soiled.

The Micro-Ringelmann

The B.S. notes state that the committee which has prepared this standard has under active consideration the preparation of a miniature smoke chart, with the intention that although it is not to be regarded as a substitute of the standard size chart, it should be of high quality.

The only miniature chart so far available is the " Micro-Ringelmann," published by the American technical journal " Power ". This is on sale in this country both from the N.S.C.A. and others. It has been criticized on the grounds that it is not as accurate as the standard chart, and therefore that its use would be open to attack if readings based upon it were submitted as evidence (presumably on either side) in legal proceedings. This criticism may well be valid, and with any copies sold by the Society a note is being included stating that it is not intended for use when legal action may follow, but only as a guide or check for preliminary observations. The same limitation is likely to be advisable also with the B.S. miniature chart, when it is produced, and possibly with the Fuel Research Station's new optical viewing instrument, described elsewhere in this issue.

With this proviso, however, the miniature charts do seem to serve useful purposes. They can be carried about in a wallet and used—unobtrusively—at any time. They also provide a means for training in recognizing smoke densities without the use of a chart. And no one is likely to consider legal proceedings on the basis of any Ringelmann reading unless it is definitely and unmistakeably above the No. 2 or No. 4 shade, allowing for all errors.

Thus we have the standard chart, which is more accurate but is cumbersome and awkward to use, frequently needs an assistant to hold it at the appropriate distance of fifty feet or so from the observer, and creates undesirable attention; or a miniature chart or instrument which can be used quickly and easily, but is likely to be less accurate and not to be relied upon as evidence in court. We also have the fact that no type of chart is of use except during daylight hours, and that results are likely to be unreliable during periods of haze, fog or rain. In any case, therefore, the use of a chart can be only a limited means for the prevention, or rather the control, of smoke emission. These drawbacks are eased, as much as the principle on which the method is based can be eased, by the very useful provision in the Act which reads (section 34(2), second paragraph): " For the avoidance of doubt it is hereby declared that . . . the court may be satisfied that smoke is or is not dark smoke as hereinbefore defined notwithstanding that there has been no actual comparison thereof with a chart of the said type . . .".

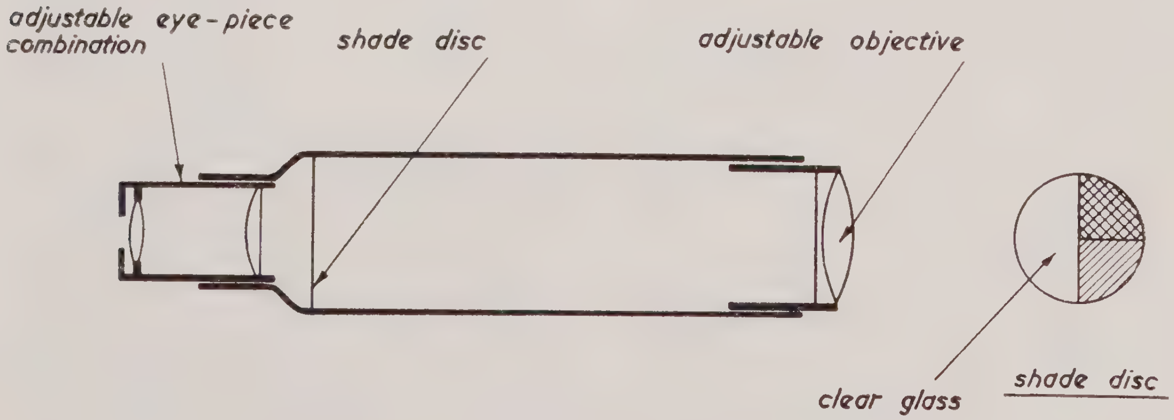
The same basis for satisfying a court will no doubt apply also in cases of black smoke emission. The moral seems to be obvious.

The D.S.I.R. Smoke-Viewing Telescope

There have been a number of instruments devised to facilitate the estimation of the density or colour of smoke but for one reason or another they have not found general favour. Something that is reasonably accurate and easier and quicker to use than the Ringelmann chart has been needed. The D.S.I.R., at the Fuel Research Station, have recently designed a telescope that has the merit of simplicity in construction and use and is stated to allow readings to be taken that are at least as accurate as those obtained with the Ringelmann chart.

The diagram shows the construction of what is essentially a low-powered telescope, in the body of which is placed a glass disc that has one-half clear and the other half divided into two translucent shades. The densities of the shades are such that they correspond to shades No. 2 and No. 3 on the Ringelmann chart.

In operation the telescope is focused on the smoke and an inverted image



obtained in the clear half of the glass disc. The smoke is then compared in turn with each of the translucent shades and the nearest match obtained. Unlike other methods of smoke density determinations, both the screen and the smoke are in focus at the same time and this makes comparison easy and imposes the least possible strain on the eyes. The instrument is portable, inconspicuous in use and requires only one observer.

It is understood that the telescope may be available, commercially, very shortly and we shall be glad to let any readers have further information as soon as it is available. It may be suggested that as Ringelmann shade No. 4 is now included as " black smoke " among the shades that will have to be observed, the shade disc in the telescope should be adapted to include this.

SMOKE CONTROL AREAS AND MINERS' CONCESSIONARY COAL

By E. J. Winfield, M.R.S.H., F.A.P.H.I.

(*Public Health Inspector, Castleford; Chairman, W. Riding Clean Air Advisory Council*)

WHENEVER control areas have come under consideration discussion has inevitably drifted to concessionary coal in mining areas with a general acceptance that it formed a major problem for those areas and a problem without ready answer. Indeed, to those residents in mining districts a problem with little hope of solution.

Paragraph 6 of Circular 6/58 of the Ministry of Housing and Local Government would appear to shatter such pessimism and the phrase " They (the National Coal Board) will extend their existing buy-back arrangements—to meet these cases " would seem to be the complete answer to all—except those who in are contact with the mining industry. Figures here, there and around support local inquiries and all indicate that this statement is either over-optimistic or entirely premature.

Without question there is no general " Buy-Back " arrangement operating; the phrase merely covers an offer made by the National Coal Board which is entirely unacceptable to the National Union of Mineworkers. True, in certain towns and cities, local arrangements have been made to meet the needs of mineworkers residing in Council-owned houses carrying a tenancy agreement barring the use of bituminous coal, but these appear to be rare and to only cover a small number of workers—so few as not to rank even as a minority arrangement.

By and large the position remains as it has done since the war; namely the National Coal Board are prepared to buy back but at a price completely unacceptable to mineworkers. We understand that negotiations have taken place between the Board and the Union, apparently without success, for as far as one can see no progress has been made and the situation is stalemate.

If Smoke Control Areas are to be promulgated in mining areas this position must be cleared, for not only does it form a practical obstacle but if issue were to be forced would produce bitter opposition amongst the persons affected. Such a situation would be fatal, for the principal of clean air needs the good will of the people to make it effective.

Let us therefore face the position squarely. Concessionary coal is something more than an industrial per-

quisite; it is in fact part of the wage structure and any variation of the concession must be considered to be a variation of wage rate. The mine-workers sees it so and naturally demands that alternative arrangements shall be equitable when viewed from a cash angle. He is not prepared to forego his inheritance for a mess of pottage, (and the latter phrase seems generous when one hears some of the buy-back offers quoted).

It would seem that schemes of concessionary coal and alternative offers vary throughout the country and that these variations add considerably to the difficulties of settlement; but surely no problem is insurmountable.

Dare one suggest that the time has arrived when this problem should be dealt with at headquarter level as a National Problem? I think so.

Let us be frank and say that such utterances as paragraph 6 are not enough. Government policy should go much further and should bring together the Board and the Union for all to study the problem and to stick at it until a satisfactory and equitable solution has been found.

Surely the Minister of Power could accomplish the desired end through such mediums as " working party " or " negotiating committee " or even by direct action.

One appreciates the complexities of the problem, of the depth of feeling of the mineworker, of the economic aspect to the Board, but must progress fail by lack of negotiation, understanding and compromise? Let us hope not. Let us rather appeal to all concerned, Government, Board and Union alike to make the effort and find the solution.

Research at Sheffield

A Report has been issued on research work carried out between 1954 and 1957 in the Department of Fuel Technology in the University of Sheffield, under the direction of Professor M. W. Thring. An important section of this work is connected with the abatement of smoke and desulphurization. Research of this nature is essential to the movement for clean air, and we would wish to see it pursued so actively in many other universities. As it is, it is hoped that the value of the contribution being made by Professor Thring and his staff is fully recognized and appreciated.

The report gives a brief summary of the researches in progress, which include the effects of town's gas/air combustion on steels during heat treatment, the rate of combustion of air-borne soot, the combustion of coal smoke, the mixing of secondary air over a fuel bed, the removal of SO_2 from flue gases by dry methods, a study of the inter-relation of sulphur oxides and soot during combustion, the smoke producing properties of coal, and the reduction of fumes from steel-making processes.

Among these subjects the removal of sulphur by dry methods is of particular interest. The potential value of a successful full-scale process can hardly be over-estimated, for it would remove all the disadvantages of the wet-washing processes. The method consists of passing the gases through a dry, granular reagent with which the SO_2 will combine. The most probable reagents are lime, chalk, iron oxides, soda ash and possibly bauxite and dolomite. The best removal has been achieved by using an 8 in. bed of dolomite at 600°C., when 90 per cent of the sulphur was removed from the gas stream.

Much of the other work described in the report, on combustion aerodynamics, carbonization, etc., is also of interest to those concerned with the technical problems of smokeless, efficient combustion.

Pictures tell Smokeless Zone Story

The London *Evening Standard* of 3rd April devoted most of one page to a pictorial feature on the benefits of the City of London's smokeless zone. (The zone, of course, is the whole city.) Under the heading " Smokeless Zone in City is worthwhile, say these Londoners," appeared their photographs, with their personal comments. We reproduce two of these, the captions being as they appeared in the newspaper. There was also a photograph of Mr. Stanley Cohen, the Society's Hon. Treasurer and Vice-Chairman of the Port and City of London Health Committee, who took the lead in creating the smokeless zone and in ensuring that it met with the success it has in fact achieved. Mr. Cohen is quoted as saying " People are as entitled to clean air as they are to clean water. The benefit to people's health is already enormous and we estimate that City property owners are saving about £200,000 a year in wear caused by dirt."

We commend this imaginative, personalized form of publicity, which by stressing unexpected facets of the case can capture public interest most effectively. Top marks to the *Evening Standard* and its reporter.

" Even the horses are livelier and their coats cleaner and glossier these days," say brewer's draymen James Sanders (left) and Charles Harrison with their bays, Wales, aged six, and Useful, eight.

" There's so little dust we might almost be living in the country," says 29-year-old housewife Mrs. Daphne Jones, who is expecting a baby in two week's time. But the Jones's live in the heart of London. They have a two-room flat on the 14th floor of the City Corporation's " sky-scraper " built four years ago.

FURTHER USE OF REFINERY GAS SUPPLIES

An agreement just signed between the North Thames Gas Board and Mobil Oil Company Ltd., provides for the supply from Coryton of at least two million cubic feet per day of refinery gas for an initial period of nearly ten years, beginning in the middle of 1959. This supply is equivalent to the amount of gas produced from 120,000 tons of carbonization coal per year. The gas will be piped from Coryton refinery to the Gas Board's Works at Romford through a 12 in. line from the refinery into a 24 in. pipeline running to Romford.

What They Say

But what am I *really* angry about? I have only to look out of the window. A mill chimney is belching black smoke, to which is being added the smoke from thousands of domestic fires, including, to be absolutely fair, my own. (But if only my master, the public, approves of my next book I promise faithfully to do something about my own smoke.) I look at the account of the Lewisham train disaster, a massacre caused by smog and made even more hideous by smog. I remember the fact that the illness which sent me from London in the winter of 1951 also saved my life; the smog which killed 5,000 would certainly have killed me.—*John Braine, author of best-seller novel " Room at the Top," so-called Angry Young Man, writing in " Twentieth Century."*

* * *

Even in smoke control areas, in which there appears to be an inordinate interest, there is no reason why the overwhelming preference for the open fire should not continue to be met.—*C. W. Moss, Technical Manager, Coal Utilization Council.*

* * *

May I be excused from representation on the National Society for Clean Air? I don't know anything about it. I haven't got the slightest interest. It is mostly cranks who have.—*County Councillor E. C. R. Hudson, Beds. C.C.*

* * *

I think smoke abatement means more to us on Tees-side than clean air.—*Councillor J. A. Brown, Chairman, Tees-side Smoke Abatement Committee.*

* * *

Concessionary coal has been part of the miners' wages from time immemorial. No one disagrees with the clean air scheme—but we do not intend to allow it to hurt the wages and conditions of our men.—*Alwyn Mache, Yorkshire Miners' President.*

News from Local Authorities

Aldershot

The bye law governing the installation of smokeless appliances in new dwellings is to be adopted by the Borough Council.

Basildon

The Council has submitted plans for a smoke control area to the Minister, covering about 2,000 houses in the New Town.

Bath

The new byelaw, governing the installation of smokeless fuel appliances in new dwellings, has been approved by the Minister of Housing and Local Government.

Battersea

Battersea Council plans to declare 50 acres of land surrounding St. James's Hospital as the borough's first smoke control area. If the Minister agrees the Council will make an order for early next year. The area is bounded by Belle Vue Road, Wiseton Road, Nottingham Road, St. James's Drive, Upper Tooting Park, Boundaries Road, Heslop Road and Ravenslea Road. There are 740 flats and houses and about 1,300 conversions will be required.

Bexley

The Council has approved the establishment of a smoke control area at East Wickham. The area is bounded by Lodge Hill, Okehampton Crescent and part of Brampton Road.

Billingham

At its meeting on 26th February, 1958 the Council authorized the making of a byelaw governing the installation of smokeless appliances in new dwellings. It also authorized the Senior Public Health Inspector to engage temporarily two women enumerators to carry out a survey of properties in the proposed first smoke control area, to enable him to report in detail to the Clean Air Sub-Committee.

Birmingham

The Minister of Housing and Local Government has confirmed the City of Birmingham Smoke Control (No. 1) and (No. 2) Orders, 1958, without modification. They will operate from November 1st, 1958.

Bishop Auckland

The byelaw requiring the installation of smokeless appliances in all new dwellings has been adopted by the Urban District Council.

Bootle

The Town Council has approved in principle the establishment of the town's first smoke control area. It comprises 123 acres of land in Netherton. There are no factories and the 1,225 houses are nearly all corporation dwellings.

Bristol

The Health Committee of the City Council approved the first smoke control area for the centre of Bristol, on 22nd April 1958. The suggested area is of 200 acres, roughly enclosed by a proposed inner circuit road. Its boundary follows a line from the City Centre along Colston Street, Maudlin Street, Lower Maudlin Street, the Haymarket, Cumberland Street, then from Brunswick Square skirting the east end of the Broadmead shopping centre to Old Market Street, thence along Temple Way and Redcliffe Way. The area includes 1,405 buildings, of which 773 are commercial or public buildings and 351 factories and warehouses. There are 281 dwelling houses, and the estimated cost of adaptions to fireplaces is £3,913.

Brownhills

On 9th April 1958 the Urban

District Council decided in favour of establishing a smoke control area for the new 70 acre Shelfield and High Heath housing site.

Bury

The Borough Council has accepted in principle a proposal to define the site of three contiguous compulsory purchase orders, along with some existing adjacent properties to be a smoke control area. The area concerned is approximately 23½ acres in extent. When the demolition of unfit houses is completed 170 dwelling houses and 30 retail premises along with 18 small factories and various public buildings will remain.

The Council will be required to assist with the conversion of domestic firegrates in the 170 dwelling houses.

Chesterfield

The Council have informally submitted to the Minister an area of 3 mining villages. This covers 321 acres and contains 467 premises.

Coventry

The byelaw requiring the installation of smokeless appliances in new dwellings came into force on 1st April 1958.

Dagenham

Marks Gate Estate is to become a smoke control area next year, it was announced at Dagenham Council meeting on 27th February.

Darlington

Darlington Corporation Development Committee have decided that the Corporation should adopt the byelaw governing the installation of smokeless appliances in new dwellings.

Dover

The Corporation are to adopt the byelaw requiring the installation of smokeless appliances in new dwellings.

Dudley

The Russells Hall Estate, when completed, will form the biggest smoke control area in the West Midlands. It is planned to build 2,500 houses. The Corporation has made a Smoke Control Order covering the whole of the 311 acres of the estate. The Order is due to come into force in November, by which time it is expected that the first 500 houses will have been built.

Ealing

The Council have declared an area of Northolt to be a smoke control area, and the Order, if confirmed by the Minister, will come into force on January 1, 1960.

Fulham

The Smoke Control Order (No. 1) has been confirmed and will come into force 1st October, 1958.

Plans are being made for a second smoke control area which will take in the whole of West Kensington. It is hoped that this second area will come into operation in October, 1959.

Glasgow

Further steps towards the establishment of a smoke control area in the central area of Glasgow are recommended by the Health and Welfare Committee of the Corporation. It is proposed that the Town Clerk and the Medical Officer of Health should prepare and submit to the Secretary of State for Scotland a provisional plan for the creation of a smoke control area. This area would be bounded on the north by Sauchiehall Street, Buchanan Street, Cathedral Street, Love Loan, and Rottenrow; on the east by North Portland Street, Albion Street, Trongate, King Street and Mart Street; on the South by the River Clyde; and on the west by Oswald Street and Hope Street.

Greenwich

A smoke control area is to be declared in the centre of Greenwich in two years time, to cover a narrow north-west strip of the borough about a mile long near the main

Woolwich Road and the Thames-side industrial area. The scheme will come into effect on October 1, 1960, provided the Minister agrees.

Grimsby

On 10th March the Health Committee approved in principle the creation of two smoke control areas in Grimsby, with others to follow in the near future. Approval was also given to proposals that the whole town should be made smokeless in ten years, beginning in 1960.

Hammersmith

It was decided at a meeting of the Borough Council on 23rd April 1958 that the Council approve in principle that the whole of the Borough be made a smoke control area by progressive stages extending over an estimated period of 10 years. It was also decided that the No. 1 smoke control area be south of King Street/Hammersmith Road, from the eastern borough boundary to Nigel Playfair Avenue.

Hampstead

The Borough Council has applied to the Minister of Housing and Local Government for confirmation of an Order making the Vale of Health, N.W.3., a smoke control area.

Hayes (Middx.)

The third smoke control area in the Urban District Council's programme has been confirmed by the Minister and is due to come into operation on 1st September, 1958. The second area has been submitted for final confirmation, as has also the fourth area.

Hull

The Minister of Housing and Local Government has approved in principle the Corporation's plans for the first three smoke control areas. The proposed areas cover 2,116 houses at Longhill, 2,339 houses at Greatfield, and a central one of 74 acres.

Isleworth

The area of the proposed smoke control area is to be reduced. The new area has 1,500 buildings in it, including factories. The previous area had 2,500 buildings. The area will extend from the Duke of Northumberland's River to London Road.

Kingswood, Nr. Bristol

The Urban District Council has decided to adopt the byelaw governing the installation of smokeless appliances in new dwellings. The approval of the Minister of Housing and Local Government is being sought.

Newbury

The Council has adopted the byelaw requiring the installation of smokeless appliances in new dwellings.

Newport

The Corporation is applying to the Minister for confirmation of the byelaw requiring the installation of smokeless appliances in new dwellings.

Nottingham

Nottingham's first smoke control area will be 57 acres round the city centre, which would include 468 offices, 306 shops, 84 factories, 49 houses and 39 flats.

Oldham

The building byelaw governing the installation of smokeless fuel using appliances in new dwellings, has been adopted by the Council, and has been confirmed by the Minister of Housing and Local Government.

Oxford

The Ministry has now confirmed the City Central smoke control area, which will come into force on 3rd November, 1958.

Stoke Newington

Stoke Newington's smoke control

area is expected to be operative from 1st January, 1959.

Tettenhall

The Urban District Council is planning to establish a smoke control area. At a meeting of the Council on 1st May, 1958 it was decided that the southern boundary of the area should be the canal from Wightwick Bank to the western boundary of the urban district.

Wandsworth

The Minister of Housing and Local Government held a public inquiry in respect of the making of the smoke control area in Wandsworth The inquiry was held before Mr. C. D. Buchanan on Tuesday, 17th June, 1958, in the Municipal Buildings, Wandsworth.

Wednesfield

Three smoke control areas, covering one fifth of the district and totalling 567 acres, have been approved in principle by Wednesfield Urban Council. They are now being submitted to the Ministry.

Westminster

The City Council, on 14th November, 1957, made the Westminster (Temple Bar) Smoke Control Order, 1957, covering an area of approximately 60 acres in that part of the City of Westminster adjoining the common boundary with the City of London and Holborn.

On 19th February, 1958 the Order was confirmed (with a slight modification) by the Ministry of Housing and Local Government.

Willenhall

The Willenhall No. 1 Smoke Control Order, 1957, has been approved by the Minister and will come into force on 1st October, 1958.

Woolwich

The Minister has confirmed the smoke control area for St. Mary's Re-development Area, and it will come into force on 1st October, 1958.

Newcastle Freeman

Mention was made in our last issue of the Freedom of the City of Newcastle being given to Alderman John Chapman. The presentation ceremony appears to have been a most happy occasion, and in a booklet recording it we find, in the speech made by the proposer, Alderman McKeag, a tribute to Alderman Chapman for his work for clean air: " It is largely due to your forceful advocacy that smokeless zones, or smoke control areas, are now imminent. I think you can be described as one of the practical visionaries of the City Council. . . . I cannot help but reflect what a fitting epitaph the following could be for you in due time "—

He hated smoke and grime
And in his time
Bade fair, to clear the air
Through which the sun might shine.

Diesel Exhaust Fumes

The Council of the British Medical Association has kept under review the problem of diesel exhaust fumes, and doubts have been expressed as to whether the amendments to the Motor Vehicles (Construction and Use) (Amendment) Regulations, which came into force on April 1st, 1957, following representations by the Association, will be effective in making it easier for the police to secure the conviction of offenders against the law. The Council has been in touch with the motoring organizations and has noted with interest their suggestion in favour of encouraging the co-operation of drivers and operators in dealing with this problem.

THE PRESIDENT

The Birthday Honours List was published as this journal was in course of printing, and brief reference only can be made to our gratification (which will be shared by all members) on learning that the President of the Society, Dr. Rudolph Lessing, has been appointed by Her Majesty as a Companion of the Order of the British Empire (C.B.E.).

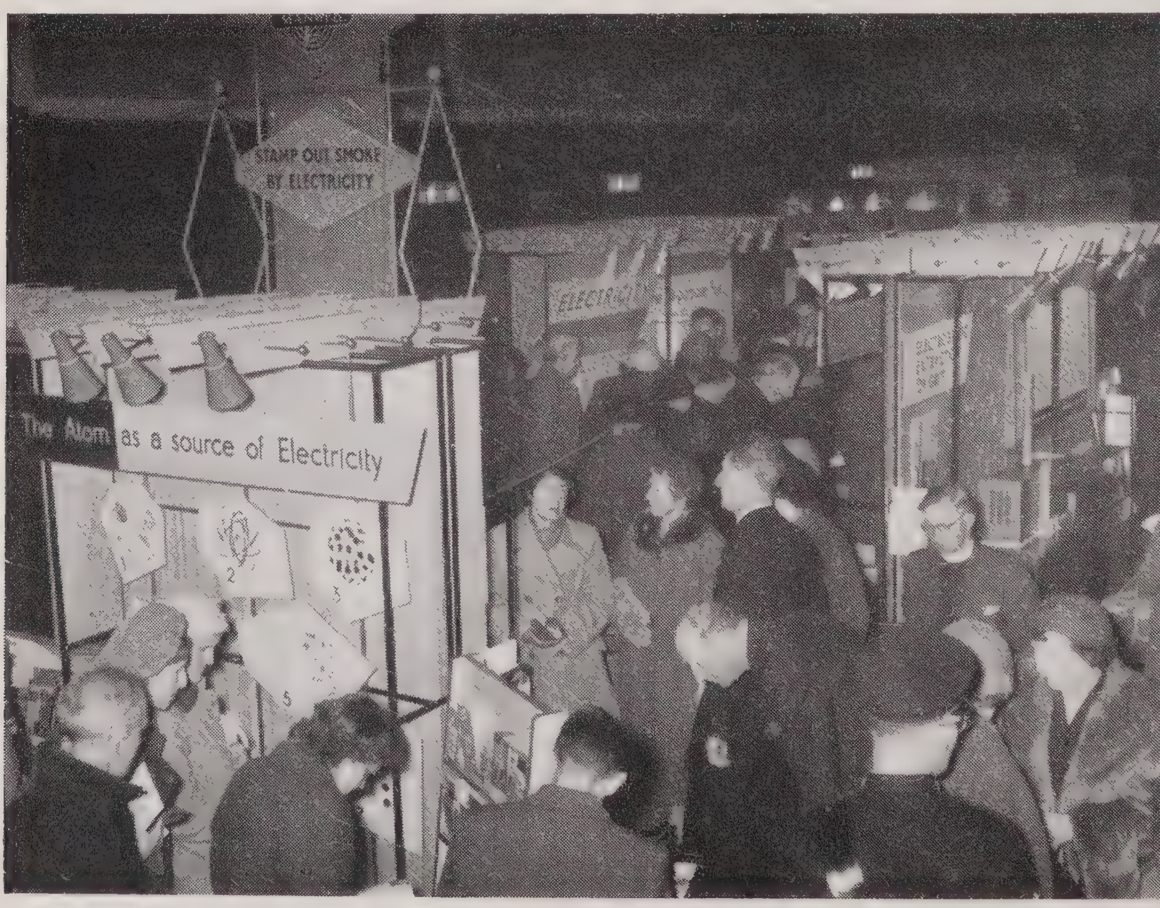
END OF THE NORTH WEST CAMPAIGN

The North West Clean Air Campaign, sponsored by the North West Division of the Society, came to a successful end in March, with exhibitions at Bootle and Liverpool. Forty local authorities participated, and there were 11 static exhibitions and 37 mobile exhibitions in the various towns.

In addition to the exhibits provided throughout by the participating organizations a number of the local authorities, through their Health Departments, provided interesting material of more local interest. An outstanding example of this was one local authority's idea of an illuminated display of local photographs accompanied by a running commentary on a tape recorder. Another prominent feature of the campaign was the poster competitions for schoolchildren.

Mr. H. V. Cass, Chairman of the Organizing Committee, states that the committee " are satisfied that the campaign has been well worth while and a most successful venture and has been a great help to local authorities in stimulating interest in the implementation of the Clean Air Act."

The campaign ended with a dinner at the Adelphi Hotel in Liverpool, at which the hosts were the Merseyside and North Wales Electricity Board, the North Western Gas Board and the Solid Smokeless Fuels Federation. A toast to the City of Liverpool and County Borough of Bootle was moved by Mrs. D. M. Charlton, and responded to by the Lord Mayor of Liverpool, Alderman F. H. Cain and Alderman Simon Mahon, M.P., member of the Bootle C.B. Council. The toast of the guests was moved by Professor



At the Ellesmere Port Exhibition of the North West Clean Air Campaign

Semple, M.O.H. for Liverpool, and responded to by Dr. R. Lessing, President of the National Society for Clean Air.

Professor Semple's speech attracted much press publicity. He emphasized that one of the main causes of bronchitis was air pollution, and said that lung cancer was also undoubtedly associated with it. "Recent tests by my department," he said, "have shown that to spend a day in Dale Street in the centre of Liverpool is the equivalent of smoking about forty cigarettes."

Photos Wanted

An increasing flow of requests for the loan of photographs, for display or reproduction, from the Society's Photo-library is creating a dearth of stock and of fresh subjects, despite the fact that the library now contains over 1,000 prints. New subjects are urgently needed, and we invite readers either to send us photographs, or if they are not photographers themselves, to pass this request on to friends or colleagues who are. What is particularly needed are first-class glossy prints (or negatives) of subjects relating to air pollution or its prevention in a striking way. Pictorial and dramatic quality in propaganda pictures are not easy to find, and really telling domestic smoke photographs are the rarest of all. The pictures used in the "From our Photo-Library" series in this journal give an idea of what is wanted. If members or others do not wish for a fee it is a help to the Society but where necessary a filing fee and standard reproduction fees will be offered.

Colour Pictures

Dr. R. S. Scorer, of the Dept. of Mathematics, Imperial College, London, S.W.7, has asked us to make known that he is looking for colour pictures on air pollution, or damage caused by it, for a colour filmstrip in the preparation of which he is co-operating. The photographs may be transparencies or prints, any size, illustrating any aspect of air pollution other than smoke from chimneys. A fee will be paid for photographs used in the filmstrip.

"Electricity and World Progress: Britains' Contribution"

The above title has been selected as the theme of the tenth British Electrical Power Convention, which will be held at Brighton from 16th to 20th June, under the Presidency of Sir George Nelson, Bt., LL.D., F.C.G.I., D.I.C., M.I.Mech.E., M.I.E.E. As in former years an Electrical Exhibition will be held in conjunction with the Convention and it will be opened by the President on the evening of Monday, 16th June. Papers to be given include "The Development of Nuclear Energy for Electricity Supply in Great Britain", "The Development of Nuclear Energy for Electricity Supply Overseas", "Britain's Part in Electrical Development Overseas", "British Hydro-Electric Plant and World Power Requirements", and "The Development of the Electrically Equipped Kitchen". An "Electrical Forum", at which a team of experts answer questions on electrical matters, forms the concluding session of the Convention.

Something Rotten?

The Union Jack was flown from the masts on most business premises and public buildings to mark the Queen's birthday. But there was no standard flying from Caxton Hall.

Three attempts were made to get it to the top of the flagpole. The third time the rope, which had been up only 18 months, broke. The soot, damp and atmospheric pollution over Westminster had rotted the rope, it was discovered. Now a steeplejack will have to fix another piece.—*West London Press.*

The Lurgi Process Comes to Scotland

"New Era" for Gas Industry

AT news conferences held recently in Edinburgh and London, Mr. Sydney Smith, Chairman of the Scottish Gas Board, announced that the Board planned to build a Lurgi gas manufacturing plant at Westfield in Fife. By the Lurgi process low-grade coals can be completely gasified. It was originated in Germany, and six plants are in operation in that country, Australia, Czechoslovakia and South Africa. The plant is to be built by Humphreys and Glasgow Ltd., at a cost of about £6,500,000.

"This marks the beginning of a new era for the gas industry in Scotland," said Mr. Smith. Outlining the implications of what he described as "this revolutionary gas-making process," he continued:

"Supplies of good quality coking coals, both in Scotland and in Britain as a whole, are dwindling rapidly. Even now, a considerable quantity of coal is imported into this country from abroad, to supplement the product of our own pits. This being the situation, any process which makes use of low-rank non-caking coal is of tremendous importance towards the easement of the nation's increasing fuel problems.

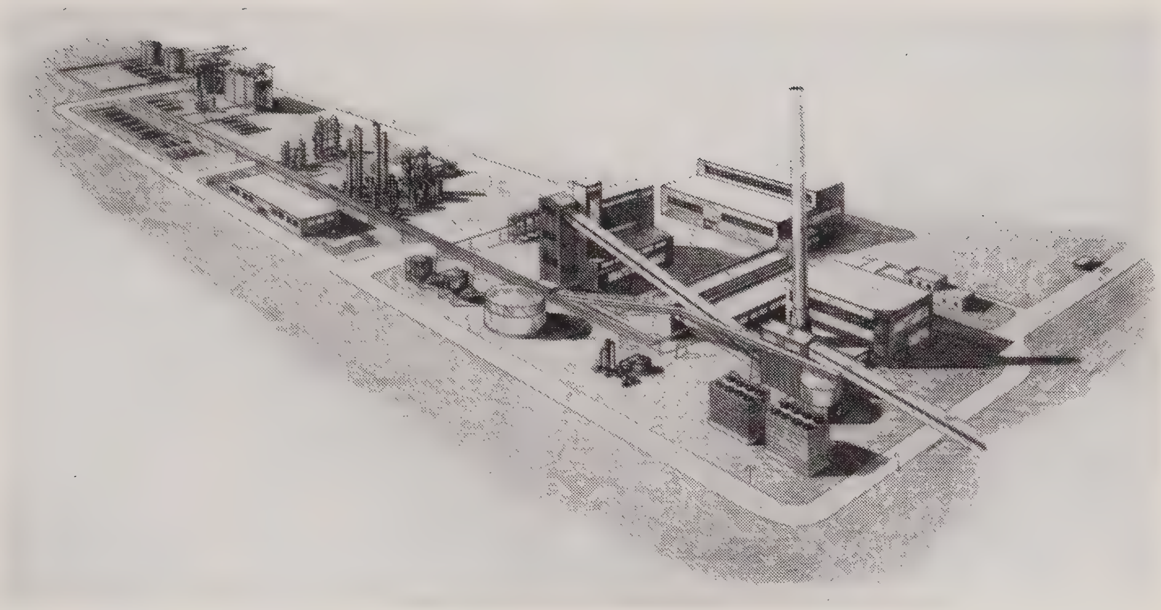
"Again, the use of existing coal deposits will lessen the need to import equivalent quantities of oil from overseas, thus helping to conserve our dollar reserves. The Lurgi plant will contribute materially to the national economy by cutting down on fuel imports. It will also, by reason of its cheaper production methods, enable us to keep the price of gas as low as possible. Because of these two vital factors we can hardly over-estimate the potential value of the new Lurgi plant."

It will take about five years to complete the plant and lay the associated high-pressure and medium-pressure grid mains which will distribute the gas over an area extending from Angus and Perthshire in the north, through Kinross, Fife and Stirlingshire, to Lanarkshire and the Lothians.

In the Lurgi process—described in a little more detail below—gas is made by the reaction with coal of steam and oxygen under high pressure. All the carbon in the original coal is converted into gas. There is no coke, and the residue is purely ash.

At first sight it might seem that this development would add to the difficulties of implementing the Clean Air Act, for which coke and other solid smokeless fuels are urgently needed. Mr. Smith pointed out that while according to the policy which the Board have consistently followed in the past, small and uneconomic undertakings will be progressively integrated, many of the remaining manufacturing units will probably continue in operation to produce prepared smokeless fuels, and to act as "stand-by" for periods during which the Lurgi plant is not in full production.

In answer to a question at the London news conference Mr. Smith stated that because of the Lurgi plant, 400,000 tons of coking coal a year will be released for other purposes. Although much of this will be needed for new coke ovens required in Scotland, the Gas Board hope to continue to obtain some of it. Existing gasworks that would otherwise go out of production would be continued and adapted for the production of solid smokeless fuel. If coke is used for heating the retorts the net coke pro-



An impression of the Lurgi gas plant to be built at Westfield in Fife

duction is only 8 cwt. for every ton of coal carbonized. If, however, gas can be used for retort heating—and the Lurgi plant will help this to be done—13 cwt. of coke is obtained.

The Process and Plant

The Lurgi process was originated in Germany by Dr. O. Hubmann and developed by him and Dr. F. Danulat to the industrial stage for the Lurgi Company. The first installed designed to carry out the process was a small unit erected at Herchfelde in Germany in 1936. The installations built since then have their own special characteristics. The Dorsten plant in Germany corresponds most nearly to the installation to be built in Fife with the primary object of producing large quantities of gas. But a modern Lurgi pressure-gasification plant may be viewed as the basis of a chemical and fuel industry. At Morwell, the Australian plant, for example, approximately one-third of the heat units in Lurgi gas are converted to liquid fuel, and two-thirds into the form of rich gas for town distribution. At Sasolburg in South Africa the plant co-ordinated processes developed in Germany and America with the main objective of producing oil from coal by the latest methods of synthesis. One reason for the development of the Lurgi process in pre-war Germany was that it offered the possibilities of synthetic oil production from indigenous sources.

When completed, the Westfield plant will have a capacity of 30 million cubic feet of gas per day. It will leave the plant at high pressure—over 250 lbs. per square inch—which will enable it to be distributed over long distances (to Glasgow, for instance) in a comparatively small main without additional boosting.

The main contract for the new works, awarded to Humphreys and Glasgow Ltd., in addition to the gas-making plant, includes all civil engineering work and buildings, electricity generating plant, and every operation in erecting the works on a site which is now open fields.

The coal will be completely gasified in the Lurgi generators at a pressure of about 25 atmospheres in a continuous stream of oxygen and superheated steam. Humphreys and Glasgow, in association with the Power Gas Corporation, have reached an agreement with the Lurgi company of Germany to build this section of the plant. It is presently planned that the plant will be fabricated in the United Kingdom.

Heat in the crude gas from the generators will be used to produce

steam in waste heat boilers. Tar, oils and ammonia in the effluent will be recovered, the ammonia being concentrated in a plant to produce a 20 per cent. solution for sale. Benzole, a valuable by-product, will also be recovered from the crude gas.

The proportion of hydrogen in the gas is increased by a catalytic conversion plant. Carbon dioxide is next removed in a " Benfield " plant. The gas is then enriched by the hydrogenation of oil. This process has been developed by Dr. F. J. Dent, Director of the Gas Council's West Midlands Research Station, where Humphreys and Glasgow have already built a one million cubic feet per day hydrogenation pilot plant.

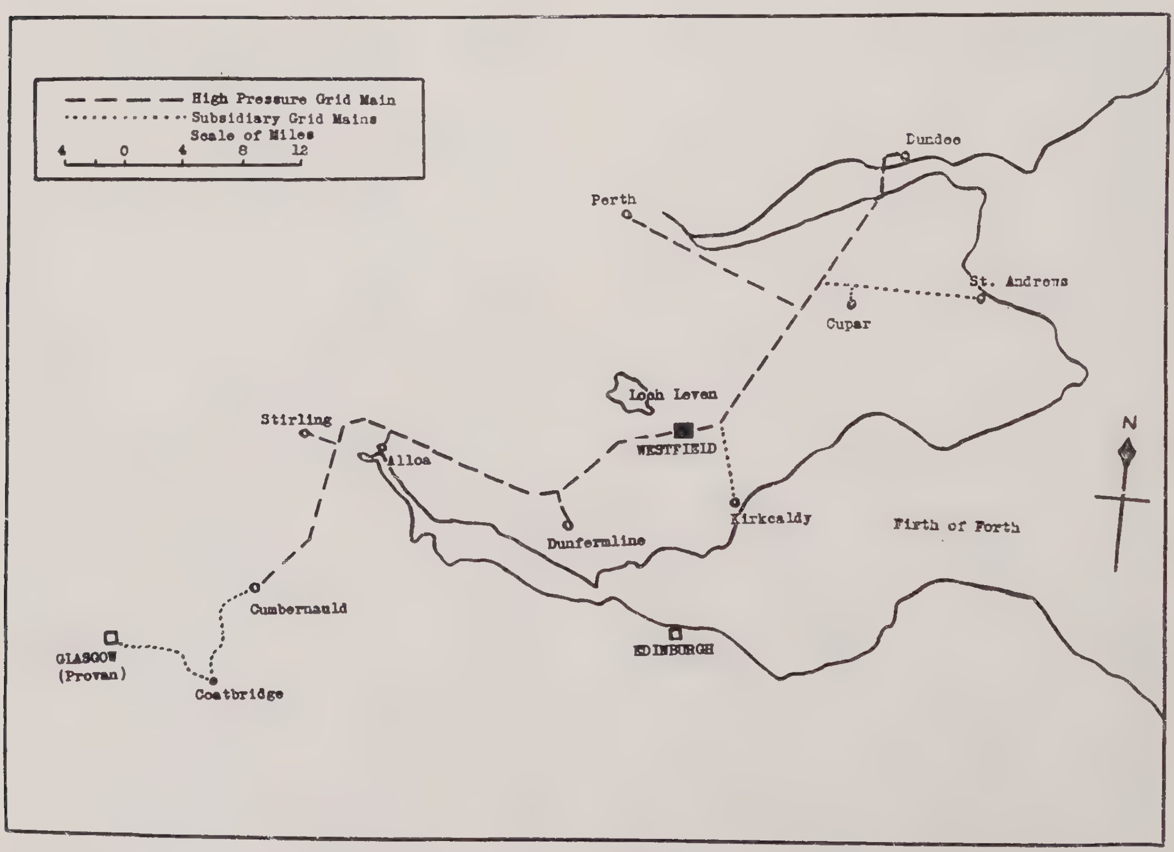
Future Possibilities

The primary object of the Lurgi installation in Scotland is the production of large quantities of gas more cheaply than can be achieved by existing production methods. But the relationship of this process to the latest developments which involve the production of town gas by the process of hydrogenation, indicates additional possibilities of development on a longer-term basis. It is a further sign of the new opportunities which are opening up before the gas industry.

The Lurgi process of pressure-gasification is largely automatic and gives the gas industry the opportunity to make use of poor-quality coal which is completely unsuitable for orthodox methods of carbonization. When in full operation the plant will produce gas of low toxicity and much reduced sulphur content. At the same time the new process indicates possible line of development for making new and valuable chemical by-products; and production at high pressure will mean that gas can be transmitted over long distances without additional boosting.

Mr. Smith concluded his statement by saying:

" The one great indigenous resource of fuel and power upon which this country depends is coal. Progress and



The 128-mile high-pressure gas grid in Central Scotland associated with the Lurgi gas plant at Westfield

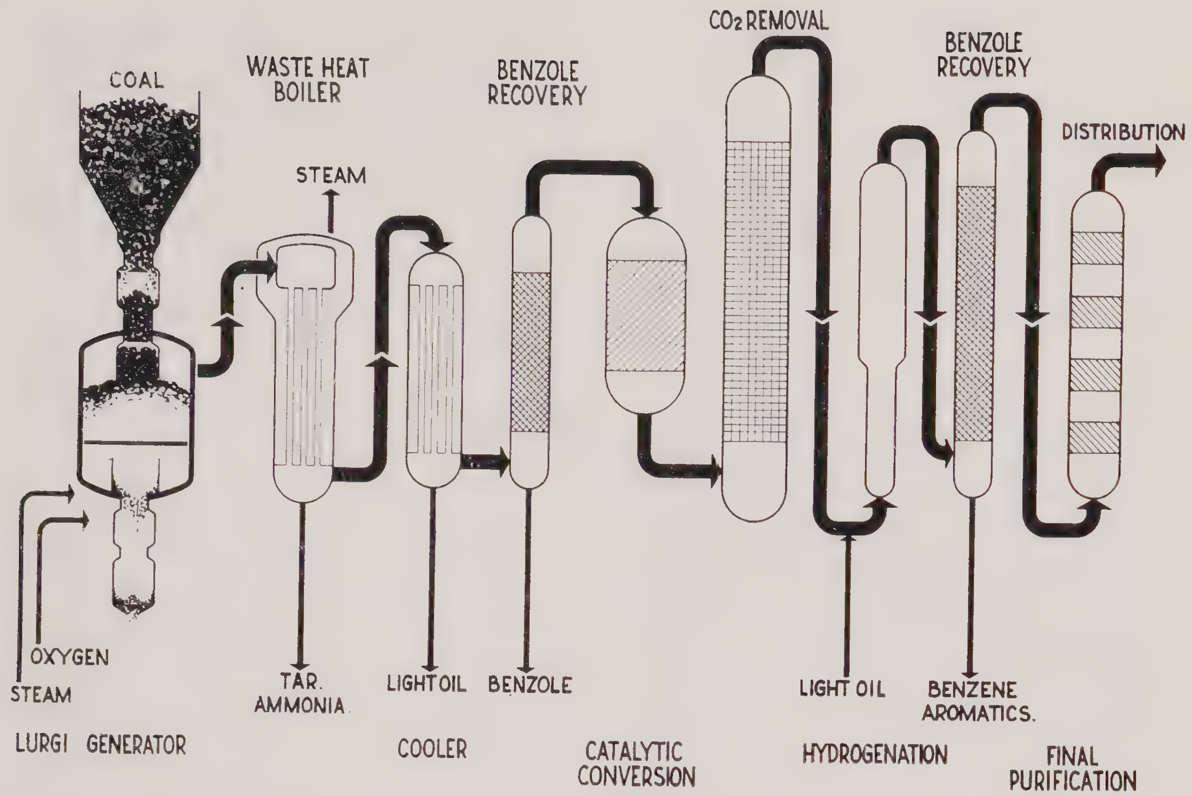


Diagram of the Lurgi pressure gasification plant

prosperity depend upon our making even better uses of all kinds of coal, regarding it not as fuel to be wastefully burned, but as a chemical raw material to be processed for the production of many substances that have become essential to our way of living, but which have been in short supply, or have had to be imported at high cost.

"It is along this road that the gas industry in Scotland is now beginning to advance. The installation of the Lurgi plant points the way to cheaper gas, a substantial reduction in the demand for better-quality coal for gas-making purposes and, in addition, the possibility of producing valuable by-products from native sources unused before."

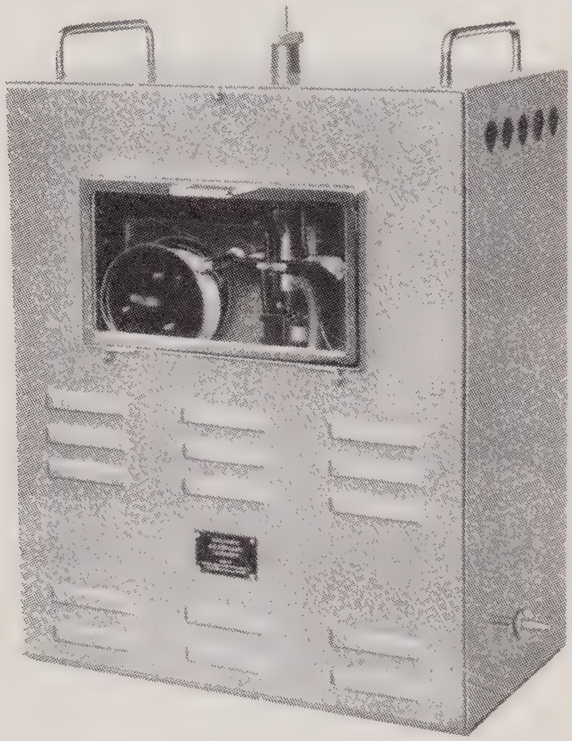
THE GAS COUNCIL'S MIDLANDS RESEARCH STATION

To develop new processes for the manufacture of gas which will enable the costs of manufacture to be kept to a minimum, is one of the principal objects of the Gas Council's research programme. The work of the Midlands Research Station of the Council at Solihull, Warwickshire, which was opened on April 1st by Sir Cyril Hinshelwood, President of the Royal Society, is largely directed to the investigation of processes for the complete gasification of low grade coals, hitherto thought unsuitable for gas making.

The work is based on the view that, for most heating purposes, the best way of using coal is to gasify it near the mines. This is also cheapest, since the cost of gasifying the coal is offset by not having to transport coal from the mines to the consumers, and by the higher efficiency of burning gas. The use of low grade coals of high ash content makes the saving even greater, and such coals are now becoming more plentiful because of mechanization in the mines.

An Automatic A.P. Recorder

It is agreed by all that the investigation of air pollution would be much more useful and informative if there were many more measurements taken, at short intervals, of the smoke suspended in the atmosphere. This is emphasized in Mr. Regan's paper recorded in this issue. A new instrument, which may prove to be just what is required for making such records, with a minimum of attention, is now on the market. It has been developed by Fleming Radio (Develoments) Ltd., and is illustrated above. Samples of air, taken at 24, 8 or 1 hour intervals, are passed by the instrument through a strip roll of filter paper, giving a dark stain. This may be compared with a set of standards and the amount of pollution in the air thus determined.



The Fleming Automatic Air Pollution Recorder

The instrument is designed to run for long periods unattended, although samples may at any time be inspected without interfering with the running of the machine.

The record can also be taken in a more permanent, simpler and more precise form by the attachment of an automatic read-out unit. When a sample has been obtained it is automatically fed through this unit. Light transmission through the sample and on an adjacent portion of clean filter paper are measured by means of two photo-electric cells. The outputs of these cells are amplified and compared by means of a bridge circuit formed by a double-triode valve. The degree of unbalance of this bridge is a measure of the density of the sample. Errors caused by variations of paper density or light source are balanced out by this method. The output from the bridge circuit is capable of delivering 1m/A into a low impedance pen recorder at maximum unbalance, giving a permanent record of the variations of pollution.

Normally, 5·45 cubic feet of air pass through the filter paper per hour, but a control unit makes it possible to take samples of $2\frac{1}{2}$, 5 or 25 cubic feet, according to the degree of pollution in the air.

The price of the recorder is £100, and that of the read-out unit, which is an additional instrument, is £25.

QUESTIONS IN PARLIAMENT

The Alkali Inspectorate and Alkali Works Order

In the House of Commons, on 6th May, 1958, Mr. Nabarro asked the Minister of Housing and Local Government and Minister for Welsh Affairs whether he will state the strength of the Alkali Inspectorate and annual cost, respectively, at the date the Clean Air Act reached the Statute Book and at 1st May, 1958; and what further increase in strength, establishment, coverage, penetration, and cost he estimates will become necessary to accommodate the added responsibilities of the Inspectorate consequent upon the transfers de-

lineated in the Clean Air Alkali Works Order, 1958.

Mr. Bevins: The figures asked for in the first part of the Question are, respectively, 10 at an annual cost of £17,480, and 19, at an annual cost of £33,730. My right hon. Friend proposes to recruit nine more Inspectors in the next year, at an additional cost of about £14,000.

Alkali Works Order

Mr. Nabarro asked the Minister of Housing and Local Government and Minister for Welsh Affairs what consultations took place between his Department and representative local authority organizations before the terms of the Clean Air Alkali Works Order, 1958, were laid before the House, and with what result; and what representations objecting to the terms of the Order he has received, and from whom.

Mr. Bevins: All the local authority associations were invited in the autumn of 1956 to let my right hon. Friend have the views on the desirability of such an Order. One of them raised objections which were developed at the public local inquiry held last summer.

Having taken careful account of these and other representations, my right hon. Friend sent the Order in draft form to the associations. No further comment was received at that stage, but since it has been laid objections from some 40 local authorities have been brought to my notice by hon. Members.

Mr. Nabarro asked the Minister of Housing and Local Government and Minister for Welsh Affairs what estimates he has made of aggregate coal, oil, and coke consumed annually by all the works delineated in the Clean Air Alkali Works Order, 1958; and, having regard to the proposed responsibility of the Alkali Inspectorate for smoke discharge as well as for noxious or offensive gases, grit, and dust, whether he will publish the figures in aggregate referred to.

Mr. Bevins: Particulars for England and Wales are not readily available, but for the United Kingdom the figures are approximately 110 million tons of coal, 17·5 million tons of coke, and 2·5 million tons of oil.

CLEAN AIR DRIVE IN WESTERN GERMANY

News about a campaign by the West German Federal Government against air pollution has been made known through a letter that has been sent out to firms likely to be interested by the Export Services Branch of the Board of Trade. This will be of interest to all readers, and perhaps of more than general interest to some. The letter, reproduced by permission of the Export Services Branch, reads as follows:

The Federal Government have recently started a campaign against air pollution by industrial undertakings. The main weapon in their campaign is a passage in the Tax Amendment Law of July 26th which allows special write-off allowances for industrial equipment purchased or manufactured during the period 1st January, 1957 to 31st December, 1960 which is directly and exclusively for the purpose of preventing, removing or diminishing atmospheric pollution. The allowance is up to 50 per cent. of the purchase price or manufacturing cost and applies to the year of purchase or manufacture and to the following year as well. The normal write-off allowance for industrial plant can be claimed in addition to the special allowance. The allowances will be set against claims for corporation tax.

The law says that the special write-off allowance will only be given in cases where the installation of the necessary equipment is clearly in the public interest and a certificate to this effect must be obtained from the competent public authority before the work is carried out. The scheme does not apply to equipment installed in buildings or extensions completed during the three years in question. German industry has already indicated its willingness to co-operate in this campaign within the limits of technical feasibility.

In pursuance of the campaign, the Federal Ministry of Labour announced on 26th October that it had sent a circular

letter to all Ministries of Labour in the various Länder asking them to make the necessary preparations so that the Federal Government's drive against atmospheric pollution could begin as soon as possible. In particular, the departments of the Länder governments concerned with the supervision of industrial premises were asked:

(a) to compile a register of all industrial undertakings in their area which were polluting the atmosphere (including as much detail as possible as to the nature and extent of the pollution);
(b) to examine the possibilities of reducing such pollution within the limits of technical feasibility; and
(c) to examine the possibility of installing equipment to control such pollution.

These departments were asked to pay particular attention to cases of pollution through the discharge of sulphur dioxide in the atmosphere.

The Federal Government's campaign seems to us to offer prospects to British exporters of equipment designed to reduce atmospheric pollution.

CASES IN COURT

Bradford

Fourteen summonses alleging contraventions of the Bradford Smokeless Zone Order, 1954, were heard at Bradford City Court on 7th May. The summonses, for emitting smoke by the burning of coal bricks, affected 27 tenants of Corporation houses and flats on the Odsal, Buttershaw and Thorpe Edge housing estates. All the tenants were given a conditional discharge, and with one exception were ordered to pay 4s. costs.

The Deputy Town Clerk, for the Corporation, said there were 20 smokeless zones in Bradford, and tenants were required by their agreements to burn smokeless fuel. Generally speaking they had observed the condition, but there had been reports of smoke from chimneys, and in each such case coal bricks had been used instead of smokeless fuel. It had been decided to bring the summonses to secure publicity.

Some tenants said they had had no coke and so had used coal bricks. Another said that there were 42 steps to his home; there was no lift and no deliverer would carry coke up.

Tottenham

A laundry summoned by Tottenham Borough Council for failing to comply with an order for the abatement of smoke, under section 84 of the Public Health Act, 1936, was fined £10 at the Tottenham Magistrates Court, with five guineas costs.

For the laundry it was said that they were in process of changing over from boilers which had been in use for many years to chain grate stokers. One was already working efficiently and when the second one was installed the nuisance would be eliminated.

Birmingham

A fine of £10 was imposed on the Midland Hotel (Birmingham) Ltd., in February, for a contravention of the city's Smokeless Areas Order, 1955. A plea of guilty was entered on behalf of the hotel company.

A smoke inspector was stated to have watched the hotel premises for half an hour and saw continuous black smoke coming from the chimney for periods of about ten minutes.

Glasgow

At Glasgow Central Police Court on 6th May the Clyde Navigation Trust pleaded guilty to a charge that on April 14, 1958, between 11.5 and 11.50 a.m. they used, caused, permitted or suffered to be used, a furnace connected with the steam boiler port funnel on board the dredger Craigiehall, while operating in the Clyde, near to Windmillcroft Quay, Glasgow, and that smoke issued therefrom.

A representative of the Trust apologized to the Court for the offence. He said that difficulties were experienced today in finding firemen in the port, and more so for coal-fired shipping working on natural draught.

Correspondence

Road Vehicle Exhausts

The Editor,
Smokeless Air,

Sir,—In your Spring issue you make reference to an exhaust smoke meter suitable for diesel engines being exhibited at the International Motor Show at Geneva. I should not like it to be inferred from this that we in this country are not fully up to date in the matter of exhaust-smoke-measuring devices, since a smoke meter exactly answering to your description (and probably in fact the same instrument) was available for inspection at the Earls Court Motor Show last October on the stand of a British firm specializing in diesel fuel-pump servicing apparatus Another firm at the same Show were able to give me details of a device working on a different principle, but apparently no less effective.

There is no lack of scientific means of measuring the density of exhaust smoke. What is now wanted is some administrative method of applying these measurements to vehicles in service.

Yours, etc.,

DOUGLAS LISTER

County Health Inspector,
Northumberland C.C.,
Newcastle-upon-Tyne.

Boiler Operators

The Editor,
Smokeless Air.

Sir.—Some time ago we received in leaflet form copies of your " Resolution and Statement on the Training and Qualification of Boiler Operators." As a trade union we are very interested in the objective aims of the Leaflet. The copies you sent have been read and discussed throughout the branches of our Association and from that source we have received many comments.

We wish you to know that many of our members have attended educational centres and received technical training in the efficient use of fuel and have obtained certificates after this training. The greatest factor operating against persuading men to attend for technical training has been the reluctance of employers to give recognition by the way of emoluments to this form of industrial efficiency and productivity in the form of fuel saving.

Two of the main factors working against the trained boiler operator are the incidence of unsuitable coal for the plant and the poor conditions of the plants themselves. The boiler operator is compelled to use the coal delivered, which at the small plants varies almost from one delivery to another with differences from good to very bad. The smaller plants are very inadequately instrumented, it is, therefore, almost impossible to know or control what is going on in and around the boiler apart from watching the chimney top for black smoke.

We could go on for a long time to write on this subject from the comments we have received but the above will show we have interest in what your " Resolution and Statement " sets out to achieve so wish the same every success.

Yours, etc.,

JOHN HARRISON

General, Secretary, The National Engineers' Association,
Manchester.

Pure Air

" The air in its natural state is remarkably pure, but the smoke issuing from the brass works, glass houses, etc., keeps the town in an almost impenetrable obscurity." Thus the author of an 18th Century guide to Bristol. The state of Bristol's air has improved considerably since then, and should improve still more with the introduction of smokeless zones, the first of which, planned to cover 220 acres, is referred to under " News from Local Authorities ".

DIVISIONAL NEWS

The eighth Annual General Meeting of the **West Midlands Division** of the Society was held at Station Hotel, Chesterfield, on the 23rd April, 1958. After the business meeting which included the result of the election of officers, and the adoption of amendments to the existing rules and constitution of the Division, the assembled representatives were addressed by Mr. Francis L. Waring, Managing Director of Coalite and Chemical Products Ltd. His address described the activities of his company and continued with a non-technical discourse on the stages involved in the Coalite carbonization processes, from the preparation of the bituminous coal, to the distillation of the by-products.

Lunch, with the Directors of the Company acting as hosts, was followed by a visit to the Bolsover works. Knowledgable guides conducted representatives on a tour of the works, the complexity of which made a great impression. After this extensive tour the tea and refreshments provided in the Head Office canteen were much appreciated. A vote of thanks was recorded to the Company and its Staff, and in particular to Mr. James Orr.

The **Yorkshire Division** held a meeting at the Civic Hall, Leeds, on 24th April, 1958, and the exhaust products of diesel engines and their effects on health were discussed. Mr. John Alcock, chairman and managing director of the Hunslet Engine Co. Ltd., Leeds, spoke of his experience with diesel engines underground, and Dr. J. E. Garside, of Leeds University, discussed diesel engines for road vehicles. Dr. W. D. Buchanan, H.M. Medical Inspector of Factories, spoke on the general health hazards of diesel fumes.

The **East Midlands Divisional Council** recently lunched in the Lord Mayor's rooms at Leicester. In welcoming them the Lord Mayor said that Leicester, awaiting confirmation of its second smokeless zone, would soon be adding to the area in which smoke would be abolished. Far from there being any resentment among manufacturers in the city over the restrictions on making smoke, there was enthusiasm, Alderman Jackson declared.

Textile firms, which relied largely on female labour and made wares of a delicate nature, appreciated the need

Members of the West Midlands Division at the " Coalite " Plant

The speakers at the Bristol meeting mentioned below, with Alderman J. J. Milton and Mr. F. J. Redstone in the centre

for less dirt and smuts from chimneys. " Industrialists in this city," he emphasized, " are only too pleased that we are getting on with the job of ridding the air of pollution." As chairman of the Health Committee he approved the desire to put the city in the vanguard in obtaining pure air. Mr. Gordon E. Chamberlain, Divisional Chairman, replying to the Lord Mayor, said that, when it came to the abatement of atmospheric pollution, Leicester had always been in the forefront.

The **North West Division's** Annual General Meeting was held on Thursday, 22nd May, 1958 in conjunction with a visit and inspection of Messrs. Threlfall's Brewery, in Salford.

A group of members of the **South East Division** of the Society, selected by ballot, were privileged to pay a visit to the Atomic Energy Research Establishment at Harwell on the afternoon of 12th May. In the short time available the visitors could only inspect a small fraction of the establishment, but even so a vivid impression was gained of the scale of the enterprise and the remarkable complexity and thoroughness of the measures used for safety and the prevention of pollution, both into the atmosphere and into water-borne wastes.

Inspections were made of the effluent farm, where every kind of waste is treated and tested, the ventilating and control system of the radio chemical laboratories, and the PLUTO research reactor. The party was entertained to tea at the end of the tour.

Conference on Smokeless Fuels

A conference on " Smokeless Fuels" organized by the Bristol and West Clean Air Committee was held in the Reception Room, University of Bristol on 23rd April, 1958, under the chairmanship of Alderman J. J. Milton, O.B.E., J.P.

" The Use of Smokeless Fuels " was the subject of the opening speaker, Mr. G. E. Curtis, Chief Public Health Inspector, Kingswood U.D.C. Following this, the Regional Director of the Ministry of Power, Mr. C. E. Asher, M.B.E., spoke about " The Availability of Smokeless Fuels ".

The discussion which followed was opened by Councillor Mrs. C. I. Rossiter, Chairman of Mangotsfield U.D.C., and Mr. F. C. Dobson, Senior Vice President of the Coal Merchants' Federation. Representatives of many organizations, including the Gas Board, National Coal Board, the Women's Advisory Council on Solid Fuel and Public Health Departments, took part in the discussion, which was both lively and unflagging.

SMOKE PREVENTION ABSTRACTS

300. Improved Sampling Equipment for Solids in Flue Gases. Hawksley, P. G. W., Badzioch, S., and Blackett, J. H. (J. Inst. Fuel. **31**, 148-160, April, 1958). Equipment is described that is suitable for the separate determination of grit, dust and smoke concentrations in flue gases. The equipment, designed as a result of extensive testing, has interchangeable parts and can be assembled in different forms for the purpose in hand. Local solids concentrations can be determined in a matter of minutes. The equipment is suitable both for routine measurements and for detailed investigations of the distributions of solids in ducts or for studying the effects of the operating conditions of the plant. The method of use is described. The simplest version of the equipment consists of a small (1½ inch diameter) dust collecting-cyclone which is inserted bodily into the gas stream at the end of a probe. The cyclone itself is used as a flow-meter. This unit when operated at sampling rates above 5 cu. ft/min at N.T.P. collects all dust particles above 5 to 10 microns. Grit particles above 76 microns (200 B.S. mesh) are separated from the dust by sieving. For the collection of smoke particles below 5 to 10 microns, the cyclone is backed with a glass-wool filter.

301. Designing a Modern Incinerator. Meissner, H. G. (Power. **102,** 80, April 1958). Main faults in most incinerators are batch feeding and lack of adequate secondary air. Combustion and expansion chambers are not effective as settling places for fly-ash. Incinerator design should take advantage of knowledge gained in burning other solid fuels. Hopper feeding of refuse to a travelling grate stoker is advocated, giving uniform and continous burning. A dust collection system is recommended, either of the dry cyclone or wet scrubber types. Refuse is regarded as containing about 8,000 B.Th.U. per lb. (U.S.). Design data is given for incinerators ranging from 50 to 300 tons per day.

302. The Weather and Atmospheric Pollution. Frith, R. (Paper presented to the Institution of Public Health Engineers, 13th March, 1958). The author describes the fundamental meteorological phenomena which have a relationship with atmospheric pollution, such as the radiation balance and its effect on turbulence, the formation of fog, and the inversion effect. This description is followed by a discussion of the effects of pollution on these phenomena and hence on the weather. It is contended that the particulate matter such as smoke will cause an increase in the amount of fog and clouds formed. The hypothesis that carbon dioxide put into the air by man's activities may cause a long-term change in the climate, is put forward.

303. Smokeless Combustion of ½-in. Smalls on Coking Stokers. MacDonald, E. J. (Engng Boil. Ho. Rev., **72,** 364–70, Nov. 1957). The effects of fuel size and rank on underfeed and overfeed combustion are discussed. Tests show that ½-in. smalls can be burned smokelessly and efficiently on coking stokers of modern design. (B.C.U.R.A.).

304. Combustion of Low-Ash High-Volatile Solids with Tangential Overfire Air. Corey, R. C. and Schwartz, C. H. (Sheffield Univ. Fuel Soc. J., **8,** 5–13, 1957). The cylindrical combustion chamber described can burn wood sawdust with high efficiency, using tangential overfire air and no undergrate air. The discharge of particles in the exit gases can be further reduced by introducing secondary air into the top of the chamber. *From Authors' Abstract.* (B.C.U.R.A.).

Abstracts—concluded

305. Air Pollution Research and Control in Great Britain. Parker, A. (Amer. J. Publ. Hlth., **47,** 559–69, May 1957). This review covers the nature and amount of some of the principal pollutants discharged into the air of Great Britain, the variation from one locality to another, methods of surveying the distribution of pollutants, results of general surveys and of special surveys, e.g. of the constituents of smog and of the carbon monoxide in busy streets, medical investigations, including a study of the relationship between the incidence of respiratory illness and the extent of air pollution, practical methods of attaining efficient utilization, abatement of smoke, dust, carbon monoxide and sulphur oxides emission, and the legislative control of pollution. *From Fuel Abstr*., 22, *No*. 4031, *Oct*. 1957. (B.C.U.R.A.).

Inter Borough Smoke Control

An interesting development in co-operation in the London area is the formation of an Inter Borough Smoke Control Committee by the boroughs of Acton, Barnes, Brentford and Chiswick, Fulham, Hammersmith and Willesden. The Chairman is Councillor E. W. Flynn, and the Hon. Secretary, Dr. F. M. Day, (Town Hall, King Street, Hammersmith, W.6.)

D.S.I.R. Report for 1956-57

The Report of the Council for Scientific and Industrial Research for the year 1956-57 is the first report of the new executive council established under the D.S.I.R. Act 1956. The Research Council has instituted a thoroughgoing review of the activities of the Department in pure and applied research in the light of the altered conditions of the present age. The report shows the main problems before the Council and the way in which they are being tackled. The publication as a whole takes a different form from that of previous years. Instead of a lengthy account of the activities of the D.S.I.R. Stations, a short statement of progress in selected researches is included. The Report is a Command Paper (Cmnd. 428) published by H.M.S.O. price 4*s*. (72 cents U.S.A.) by post 4*s*. 4*d*.

Brief Note

Among recent papers that we had hoped to report more fully, and which should be noted, are one by G. E. Curtis, C.P.H.I., Kingswood, read at the recent meeting of the Bristol and West Clean Air Committee; one on the weather and air pollution by R. Frith of the Meteorological Office, read at a meeting of the Institution of Public Health Engineers; an article in the *Medical Officer* of 11th April by Dr. William J. A. Rae, M.O.H., Aberdeen, on " The Efficiency of the Clean Air Act "; a paper read to the Tyneside Clean Air Committee by G. R. Nellist, of the N.C.B., on the implementation of the Clean Air Act on Tyneside; and an article on " Smoke Density Recording," by R. D. Miller in the March issue of *Instrument Practice*.

Electric Fire Kindler

Mr. P. H. G. Grimmett, Chief Public Health Inspector, Wednesfield has sent us a report of experiments conducted on an electric fire kindler loaned to him by the Kindler Electric Co., The Greys, High Street, Harlington, Middlesex.

Measurements of Smoke Emission. Part 1. Medium capacity coal-fired water-tube boilers with travelling grates. (British Standard 2978, Part 1; British Standards Institution, 5s. net.) This volume has just been received and will be reviewed in our next issue.

Clean Air and Meteorology

A Joint Meeting

A most successful joint meeting of the Royal Meteorological Society and the National Society for Clean Air was held in Agriculture House, Knightsbridge, London, on 13th May, with over 200 members present. The four papers read dealt with subjects of common interest to the two societies and are printed in full below. Dr. R. Lessing, President of the N.S.C.A., was in the chair for the first part of the meeting, and for the second part, after a break for tea, the chair was taken by Dr. R. C. Sutcliffe, O.B.E., F.R.S., a Past-President of the Royal Meteorological Society and Director of Research, Meteorological Office.

PROGRESS IN ATMOSPHERIC POLLUTION RESEARCH

By C. J. Regan, B.Sc., F.R.I.C.

(Formerly Chemist-in-Chief, London County Council)

IT was with great pleasure that I received the invitation from the Society to present a paper to this meeting on this subject; for, as Chairman of the Atmospheric Pollution Research Committee of the D.S.I.R. I appreciate the compliment implied to the work of that Committee, which is the oldest Research Committee still active in the cause of clean air. Its origin was as far back as 1912 so that it is within a short distance of its jubilee, which must be a source of great satisfaction to our President, Dr. Lessing, who was one of the band of enthusiasts at the formation of the original Committee.

In the early days it was the measurement of pollution upon which efforts were concentrated. That was obviously a correct first approach but having obtained at least a partial picture of the incidence more attention has subsequently been given to the effects of pollution and the possible means of abatement.

As in so many other scientific fields it can fairly be claimed that Great Britain was the pioneer in atmospheric pollution research. Probably this was a natural consequence of the fact that it was the leader in industrialization which involved urbanization with densely populated areas consuming large quantities of fuel.

Now however, the importance of clean air is universally recognized and the subject is, indeed, receiving international attention through the World Health Organization.

So far as this country is concerned the main landmark on the road of progress was the report of the Beaver Committee published in November, 1954. In this much attention was given to the subject of research, and Appendix 3 to the report was entitled "Research and Development." The last section of that appendix was headed: "Matters on which further research or development work is required." So perhaps the best course for me in the short time available is to consider progress since that time in some of the fields of work listed in the twelve subsections of the summary.

The recommended intensified measurements in the London area and in some other large towns are now being made. There are, in the whole country, under the auspices of the Fuel Research Station in co-operation with the Standing Conference of Co-operating Bodies, a total of about 3,000 instruments measuring pollution, mainly on a monthly average basis. The latter type are now generally sufficient in number but there is still a need, especially in areas liable to smog, for an increase in the number of instruments to measure smoke and sulphur dioxide at daily or even shorter intervals. In periods of smog it is essential to have information of variations through the day and the maximum reached, and the installation of instruments of an automatic or recording type is required. For example, officers of the Central Electricity Authority have devised a recorder for sulphur dioxide which has given satisfactory results and which will, I believe, soon be generally available.

My old colleagues at County Hall, too, have in operation several sets of apparatus working on a time switch system which can give short period readings of smoke and sulphur dioxide. The usefulness of results obtained by these instruments is clearly demonstrated in a report on Atmospheric Pollution and Health published as an appendix to the report for the year 1956 of the Medical Officer of Health, London County Council.

Fortunately so far as the general well being of the community is concerned, but unfortunately as regards research into the incidence and effects of atmospheric pollution, there have in recent winters been no prolonged smogs such as that of December, 1952 which caused 4,000 deaths in London. When such an event happens again there will undoubtedly be available a much greater body of information as to the concentrations of pollutants which occurred.

In the winter of 1955–56 a scheme was organized by the Fuel Research Station whereby volunteers, mainly Civil Defence workers, were available to take manual readings during any fog warning in Birmingham, Glasgow, Leeds, London, Manchester and Sheffield. It came into operation on three occasons but in no instance was the fog persistent or very dense. Nevertheless much useful information was obtained. It appeared that there was a statistical correlation between the mortality rates and the measurements of pollution in various London boroughs. The pollutant which showed this correlation was smoke, and a similar conclusion was arrived at in the independent investigation described in the London County Council report to which I have already referred. A clinical investigation made at that time and described recently by Waller and Lawther into the condition of a group of 180 patients in Greater London suffering from chronic bronchitis also reached the same conclusion; but they have pointed out, quite rightly, that although smoke was used as the index of pollution the harmful effects may not have been and probably were not, entirely due to this. The possible role of sulphuric acid is discussed by them and it may well be of great importance; for although no direct statistical correlation of sulphur dioxide with mortality and morbidity was discernible the figures available were not sufficient to be conclusive and more work is

necessary on the sulphur aspect of the effects. It is worth recalling that Dr. Logan estimated that the relatively short and mild fog in January, 1956, which was one of those included in these investigations, caused 1,000 deaths in London.

Sulphur

Probably the question of pollution by sulphur compounds has provoked more controversy than any other; and it must be frankly admitted that no spectacular progress has recently been made in any aspect of it. So far as human health is concerned there is still much work to be done on the biochemical and medical problems. For example, on the relative importance of the two oxides and the effect of the presence of particulate matter: does this catalyze the oxidation of the dioxide to the trioxide and thus increase the toxic effect? And what is the role of humidity and that of varying size of acid water droplets? In any case, sulphur pollution is undoubtedly responsible for much corrosion of metals and other materials, and should therefore be prevented so far as possible. Coal washing has increased, but can only contribute slightly: almost all the sulphur remaining in the fuel goes up the chimney. Gas washing with water and added chalk continues at Battersea and Bankside power stations but is costly and difficult from the maintenance aspect. Moreover, owing to the cooling of the gases, although 90 to 95 per cent. of the sulphur oxides is removed, the effect in the immediate vicinity may on occasions not be altogether beneficial.

The use of high chimneys as an aid to dispersal has been studied and at the suggestion of the Atmospheric Pollution Research Committee work on this is proceeding at the Meteorological Department of Imperial College as an extra-mural contract for the Department of Scientific and Industrial Research. This may well produce important results.

Other work on sulphur which should be mentioned is the survey which has been conducted for several years by the Fuel Research Station in the neighbourhood of Staythorpe Power Station. This is in a rural district isolated from other sources of pollution. The results over several years have recently been investigated, particularly from the meteorological aspects, by two members of the staff of the Meteorological Office (Mr. Meade and Dr. Pasquill), who are both members of the Atmospheric Pollution Research Committee; they have shown that, as the coal consumption at the station has increased, there is a definite statistical correlation between the total sulphur consumed and the sulphur oxide content of the air in the neighbourhood as measured by a number of lead peroxide cylinders. This work is continuing and it is a good instance of a case where recording instruments to give information at shorter intervals than one month would be a great advantage.

Under the auspices of the D.S.I.R. Working Group on the Removal of Sulphur Compounds from Industrial Gases work has been proceeding at the Fuel Research Station on other possibilities: for example, in addition to the pilot plant scale trials of the Fulham-Simon Carves gas liquor washing process now being made at a power station at Nottingham, a wet manganese dioxide process is being investigated. In this, the flue gas passes through a suspension of manganese dioxide in the scrubbing liquor with the formation of manganese sulphate: sulphuric acid is subsequently recovered by electrolysis. The process works but would have the disadvantage, previously mentioned, of cooling the gases, Research has also been proceeding on the possibility of devising a dry process to retain the sulphur in the furnace ash by adding a material to the fuel, for example, dolomite. (*a*) Manganese dioxide, (*b*) alumina-gel impregnated with manganese sulphate and ignited to the oxide and (*c*) active carbon, are being tried for direct absorption of SO_2 from the flue gas and work is still in progress.

Motor Vehicles

The importance of exhaust gases from motor vehicles has in recent times been increasingly recognized, and has been emphasized by experience in Los Angeles. A vast amount of research is proceeding on this subject in the United States and much work is also being done here at the Fuel Research Station. The problem is very complicated for the exhaust products vary with (*a*) type of fuel, petrol or diesel, (*b*) phase of operation, starting, cruising, accelerating or decelerating, idling, (*c*) type of engine, setting, etc.

The contents of the exhaust consist of unburnt fuel and partially burnt fuel, containing for example, carbon monoxide, aldchydes, oxides of nitrogen and hydrocarbons, etc. in great variety. The toxic possibilities of many of these are not known and much difficult work is necessary in the analytical and biochemical and medical fields before the final picture can be seen. But there is no doubt that exhausts can be harmful and hence the quantity emitted into the atmosphere should be minimized.

Two general methods of approach to this problem are available: (*a*) improvement of engine system design to decrease the amount of fuel passing unburnt, and including the possibility of a carburettor system which will be self adjusting according to the type of operation; (*b*) the use of a catalyst or of an after-burner in the exhaust system to oxidize unburnt fuel. Research on both these lines is proceeding and, in particular, I should like to mention the good progress made at the Fuel Research Station in testing the catalyst type. So far the results are promising.

Mention should be made of research in relation to agriculture and horticulture. Much has been done, particularly in California, and it is gratifying to know that work has now been initiated in England in relation to forestry. A considerable scheme has been started by the Forestry Commission to investigate the effects of pollution on trees. The sulphur oxide figures as determined by the lead peroxide cylinder method in areas around the Pennines are surprisingly high and the progress of this work will be of great interest and importance.

I should have liked to deal with many other aspects of Atmospheric Pollution Research but, instead, time compels me to list just a few of them:

1. The development of smoke indicators.
2. The increased production of smokeless fuels.
3. Improvement of domestic appliances.
4. Abatement from special chemical processes: e.g. the metallurgical industry and the ceramics industry.
5. The potential importance of oxides of nitrogen.
6. Radio-active fall-out.

One final point which should be emphasized is the absolute necessity for the closest possible system of liaison between all research workers in this field. Almost every country in the world is now recognizing the need for clean air and the number of workers is enormous. In order to prevent overlapping and duplication of effort it seems essential that the best practicable system of circulating information and abstracts of literature should be devised. Possibly this could best be achieved through the World Health Organization which now has a Committee dealing with air pollution.

To summarize this brief review of progress: a vast amount of research is now proceeding on Atmospheric Pollution and in many fields good progress is being made. In general the way forward is clear to abate smoke and dust and grit. Also research on the motor vehicle exhaust problem is proceeding reasonably well. But as regards sulphur little progress has been achieved; it is, in fact, an extremely difficult problem from many aspects and it can only be hoped that intensified effort will ultimately reveal the answers.

THE INTRODUCTION OF SMOKE CONTROL AREAS

By W. C. Turner, M.D., B.S., M.R.C.S.

(Medical Officer of Health, Poplar)

THE Royal Meteorological Society and the National Society for Clean Air are to be congratulated on getting together again in joint session. So much has happened since last we met over thirty years ago. As a member of both bodies I regard it as a singular privilege to have been asked to deliver a paper at this Meeting.

No study of air pollution is complete without consideration of the effects of the weather on the concentration of air pollutants at or near ground level, yet how often does one see even a simple correlation between deposited matter and wind direction or speed?

Winds cause turbulence and peculiar eddies, which may bring down to ground level, in unpleasant or dangerous concentration, gases omitted even from tall shafts and during periods of very cold weather, stable conditions of temperature inversion may interfere with the normal dispersal of air pollutants, which accumulate and may reach concentrations of physiological and toxicological significance, producing undesirable effects—even death—in susceptible subjects.

Not only does weather affect air pollution, but locally pollutants may affect weather, this is clearly seen in the difference between town and country during the winter.

Pioneer efforts in the past, at first by enlightened individuals later taken up by voluntary societies, resulted in progress in the evolution of preventive medicine and finally the advances made were consolidated by legislation. Thus were the purity of the water we drink and the food we eat safeguarded but we still have to breathe any filth put into the air. We have had to wait until the second half of the twentieth century for law to secure some improvement in this respect, but pure air, so vital to healthy living still seems a long way off. The National Society for Clean Air was fortunate in the foresight of its founders and must be praised for its tenacity during the last half century in continually stimulating both public and legislative opinion, culminating in the passing of the Clean Air Act, 1956.

Pioneer days are passed and we must now make the best use of the new powers, preferably by the education and persuasion of offenders until they co-operate whole-heartedly from a new sense of social virtue. Economies from the more efficient use of solid fuel will be a tangible reward.

Whilst the main provisions of the Act are directed towards the abolition of dark smoke, for the first time recognition is made of the seriousness of the nuisance from domestic smoke in the controls to be applied to houses in " Smoke Control Areas," and in the use of " Authorized Fuels."

Domestic Smoke

Domestic smoke is responsible for more than half the total smoke from all sources; in towns the chimneys from which it is emitted are in crowds, at roof top level and the maximum output occurs during the evenings in the coldest weather. The gases are cool because of entrained air and they contain unburned volatile components of the fuel which are hygroscopic, tarry, corrosive and dirty. Combination of effects in suitable weather produce killer " smogs." I make no excuse for the use of this descriptive word as it was coined by Dr. Des Voeux, a former President of the

Society for Clean Air.

Domestic smoke still lacks the condemnation it deserves, and it is quite certain that the amenities of urban existence will be vastly improved when all particulate matter in the air arising from the combustion of fuels, especially the low level discharge from house chimneys, is eliminated.

A recent paper by Dr. Scorer evaluating the cost of pollution attributable to different sources, quoted figures which put a new perspective on the condemnation of house smoke.

For meteorologists interested in air pollution it is important to appreciate the variable qualities of smoke from different sources, in particular the quite considerable differences in physical and chemical properties, between domestic and industrial smoke and how it arises.

The difference is a function of the temperature of combustion. In efficient boiler house practice, the temperature of the furnace is such that the volatile components of bituminous fuel are distilled off rapidly, adequate secondary air introduced with sufficient turbulence, mixes intimately with the hot gases which are completely oxidised; the flame adding its quantum of radiant energy to the heat from the incandescent fuel. Ideally there should be no smoke. The effluent is almost completely gaseous; from the air introduced, there remains nitrogen and from the fuel components, the carbon and hydrocarbons are oxidised to carbon dioxide which approaches 18 per cent., and water vapour; with stable oxidized products of other elements present, e.g. sulphur dioxide. In badly fired furnaces, the absence of sufficient secondary air and lack of turbulence create a reducing atmosphere in which the volatile distillates undergo "cracking" and carbonaceous compounds may be reduced to molecular carbon which is emitted as black smoke. The carbon tends to flocculate and settle out rapidly as soot and smuts visible to the naked eye. It is obvious that these are the extremes and that every variation is possible between them.

What happens on the domestic hearth is another story. The fire is not confined and the overall temperature of combustion is therefore much lower, the coal is slowly heated up and there takes place a fractional distillation. As the various volatiles are given off they are cooled below ignition temperature by the large volume of air passing over the fire, the volatile distillates, condense or sublime forming smoke particles which become entrained in the air passing up the chimney. Because of the cool temperature domestic smoke lacks buoyancy, a factor which makes the low level of discharge particularly undesirable.

With efficient industrial combustion the gases are emitted in large volume and at high temperature, which gives the effluent buoyancy and higher energy to the gas molecules which separate rapidly to infinitely low concentration, the achievement of high dilution before reaching ground level being assisted by height of discharge and normal air movement.

The smoke particle condensates from domestic chimneys do not behave quite like true gas molecules. They are much larger, very numerous and efficient condensation nuclei, and by reason of their peculiar physical and chemical properties absorb moisture and other pollutants, increasing still further in size, finally reaching a state of physical and chemical equilibrium with the air and remain in suspension for long periods. This process increases the opacity of the air and under certain conditions the haze which may thicken and become dense freezing smog which we know from past experience can be very stable and persistent. I am quite sure that in the absence of particulate nuclei from smoke, town fogs would lose most of their lethal properties. One very important property of these smoke condensates is that they fall within the critical range of particle size which can reach and be retained in vulnerable parts of the lung. That they are retained there is no doubt whatever and repeated exposure is probably a most important exciting factor in

causing changes in the lung substance which may progress to serious chronic respiratory disorder.

The devastating effects of coal smoke are so widespread that the burning of raw bituminous coal in unsuitable domestic appliances should have been banned; at one stroke the effect on urban amenity would have been enormous, and the results could have been achieved without the cost of the installation of expensive iron-mongery coming from the national purse.

This assumption is based on a knowledge of the local fuel habits of Londoners in the past. In districts near gas works, coke could be collected at nominal charge, and although of necessity, it was the fuel of choice. The cockneys, and others, acquired the knack of burning this fuel on the variety of Victorian grates with which their houses were fitted. Many minor adaptations to increase the depth of the fuel bed were made, and coke is still being burnt on these grates. The cost of replacing all these grates because the present generation have forgotten how to burn coke on them is likely to delay the full benefits of the Clean Air Act for decades. The enormous financial burden could have been lessened and avoided had there been available adequate supplies of reactive cokes.

Fuel Policy

There is an urgent need for a realistic fuel policy under a National Fuel Board, with Nuclear, Coal, Electricity and Gas Divisions co-ordinated and not, as at present functioning in isolated competition. We should be looking ahead to a much greater use of electricity in new building, in anticipation of the increasing output from nuclear power sources. Gas Boards have a statutory responsibility, the primary object of which is to produce gas. There are, currently being explored, methods to increase gas output which include: the total gasification of coal, underground gasification of coal in seam, gasification of oil; modification of oil refinery products and even the importation of liquid natural gas in refrigerated tankers. Increase in the production of the by-product coke does not appear to have much place in this programme. Coal which could well be used for gasification and the manufacture of reactive cokes is still being diverted to domestic consumers, or being deposited in quarries where it will slowly oxidize, disintegrate and become unsaleable. Where are we to find the increase in output of solid smokeless fuels to meet the demand anticipated?

Having made these points I do not wish to labour them because the Clean Air Act is another milestone in our legislation for social improvement and can bring enormous benefits from the intelligent application of its provisions.

Although the Act makes no provision for dealing with sulphur oxides and other gases, the elimination of the nuisance of domestic smoke may well be an important key to the health problem. The maximum permitted concentration for regular exposure to sulphur dioxide in industrial practice is much higher than is met with in the air. It appears to be well tolerated by those exposed, and a search of international medical literature on this subject fails to disclose adequate evidence that sulphur dioxide under industrial conditions of exposure is a cause of chronic respiratory disorder or that the health experience of the workers is significantly different from that of the general population. This is I am sure related to the extraordinary efficiency of the scrubbing and buffering capacity of the healthy upper respiratory tract. There is need for a much more critical evaluation of the effects of substances more toxic than sulphur dioxide, and the possible effect of the interaction of pollutants and their synergistic activity, and the effect of repeated exposure superimposed on chronic irritation due to prolonged exposure to tobacco smoke.

Nevertheless, sulphur dioxide, because of its generally undesirable properties, should be eliminated from the air we breathe.

Smoke Control Areas

So far I have said little about the introduction of smoke control areas because I think that a proper understanding of factors underlying the essential need of this type of new development are more important to the present audience.

The law relating to smoke control areas is straightforward and can be made to work providing financial considerations do not slow it down before an effective start is made.

There are four stages on the procedure for establishing smoke control areas:

(1) decision in principle on the location, size of the area and types of property to be included, and notification to the Minister of provisional plan;

(2) after receipt of the Minister's comments on the provisional plan, the detailed survey of the area;

(3) the making of the Order, the carrying out of the statutory procedure and submission of the Order for confirmation;

(4) after confirmation, action to bring the Order into operation, payment of local authority grants and claiming of Exchequer contributions.

The aim of the Smoke Control Order is to reduce the degree of air pollution. It prohibits the emission of smoke from any chimney in the area, but exemptions from the provisions are possible.

Any Smoke Control Order may be revoked or varied by the Minister who, in an emergency, can also make a Suspending Order or Relaxing Order.

In premises to which Smoke Control Orders apply solid fuel appliances in which smokeless fuel cannot be burned satisfactorily will have to be altered or replaced. Such adaptations may be carried out by the owner or occupier on his own initiative or after the service of Notice by the local authority or by the local authority itself in pursuance of its powers.

Payment is only made if the expenditure is incurred after the confirmation of the Order but before its coming into operation. The local authority re-pays to the owner or occupier 7/10ths of the approved cost and may, if it thinks fit, pay the balance but the Exchequer Grant in all cases is 40 per cent. of the approved cost.

The serious problem of air pollution and the measures to be invoked to secure improvement are well-known to members of the Society for Clean Air and I only hope that my brief survey of some of the problems will be of help and interest to our meteorological colleagues.

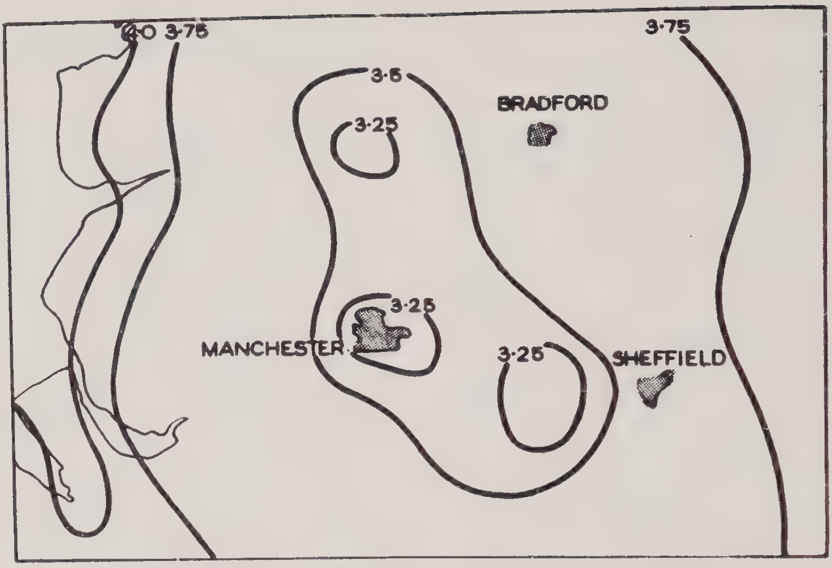
SOME CLIMATOLOGICAL ASPECTS OF AIR POLLUTION

By R. G. Veryard, B.Sc.

(*Meteorological Office*)

PERHAPS the most well known climatological aspect of atmospheric pollution is its effect on the transparency of the air to radiation, whether it be the ultra-violet, what is called " bright " sunshine, illumination, or what is known as visibility. Because it is well known I propose to deal with this aspect very quickly.

In regard to ultra-violet radiation, the famous Leicester Report (1945) showed that even a comparatively small industrial area like Leicester receives only one-third of that received



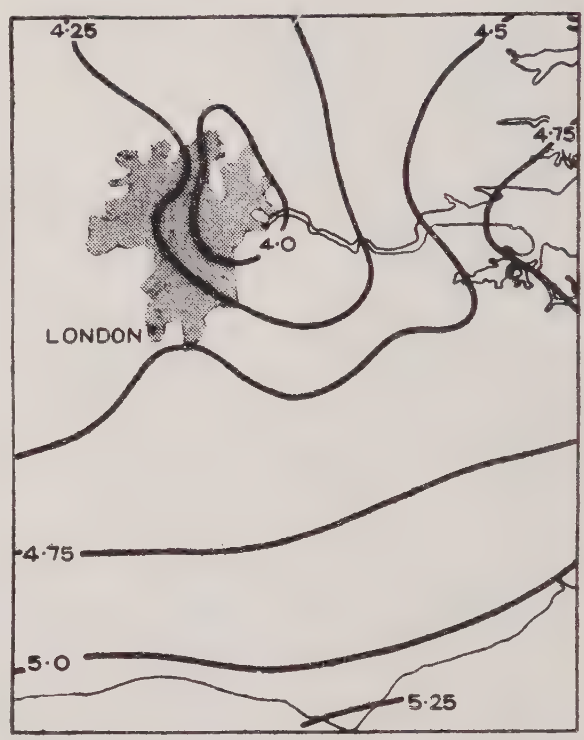
Daily Mean of Sunshine for period 1949-53

Fig. 2

in the clear open countryside; in regard to illumination, it was found that the centre of the city received only half the illumination received outside the city. It is estimated that on a really dirty winter day in London nine-tenths of the daylight is lost because of smoke.

In regard to sunshine as recorded by the Campbell-Stokes instrument, Fig. 1 shows the loss of sunshine during the period 1949-53 over London based on daily mean values; it suggests an average daily loss of at least 45 minutes. Fig. 2 is a similar diagram for the Manchester area from which it can be estimated that there was an average daily loss of at least 30 minutes; it is difficult to think of any cause other than the effect of smoke for the decrease of sunshine between the 3·75 line near the coast and the 3·75 line over the hills to the east of Manchester.

As a smoky atmosphere is much more opaque to short-wave radiation than to long-wave radiation, the possibility of man-made dust contributing to variations in the general radiation balance cannot be ruled out: there is evidence from observations at Kew that the London atmosphere absorbs up to 10 per cent more than it should and reflects up to 10 per cent more that it should.



Daily Mean of Sunshine for period 1949-53

Fig. 1

There is hardly any need for me to mention the effect of pollution on visibility. Using a long series of observations made continuously at the same point and by the same rules at Prague, Czechoslovakia, Hrudicka (1938), showed that on the average, there were about 82 days with fog per year in the 1880's since when the number has doubled with the

increase of pollution. At London Airport in the winter months, visibility less than 1,100 yds. is about ten times more frequent in easterly winds, i.e. from the bulk of Greater London, than in westerly winds. It is worth mentioning, perhaps, that a feature of the dirty fogs of an industrial area is their persistence. G. M. B. Dobson (1948) has pointed out that this is attributable to the fog droplets having dissolved the sulphur dioxide present in the polluted air forming sulphurous acid which then oxidizes into sulphuric acid and tends to reduce evaporation when the relative humidity falls. Another reason, of course, is that less radiation can penetrate a dirty fog than a clean fog so there is less chance of the sun warming the ground and thus helping to burn off the fog if it is of the dirty type.

I am quite sure that all who are present here this evening are fully aware of the appalling damage both to health and property which is caused by pollution—damage such as that of the tragic loss of life in the Meuse Valley in 1930, at Donora in 1949 and, worst of all, in the London "Smog" of December 1952. These are but peaks in a continuous insidious process, a process which, for example, is gradually converting our beautiful House of Commons into epsom salts.

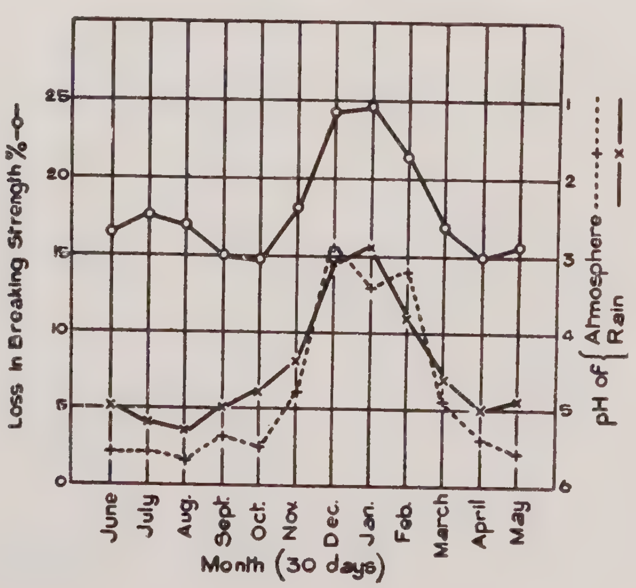
But it may be of interest to give just one example of the lesser known effects of pollution. Fig. 3 shows some results obtained by Edward J. Race (1949) at Leeds. In outdoor exposure tests of cotton yarn he found a greater loss in breaking strength in winter than during summer—in spite of the fact that sunshine together with oxygen causes rapid breakdown of callulosic materials. Race was able to correlate his results with the changing *p*H value of the atmosphere and of rainfall from month to month. Race estimated the average daily discharge of sulphuric acid in Leeds during a winter as considerably in excess of 40 tons, whereas in summer it is less than 15 tons.

Smoke and Rainfall

In regard to rainfall, two interlinked questions which have yet to be answered satisfactorily are (*i*) what effect, if any, do smoke particles have on the initiation and distribution of rainfall, and (*ii*) how effective is rainfall in the removal of pollution?

In regard to the first question, it is now well known that for the formation of cloud particles it is necessary for condensation nuclei to be present in the air. It is contended by some experts that there is an ample supply of natural nuclei available for the condensation process and that there is no need to call upon man-made nuclei for this purpose.

Fig. 3



For the formation of rain the cloud particles must somehow grow to rain drop size. This requirement has been the subject of much research and it appears that either the presence of ice crystals is required (so that cloud particles distil over and grow on to the ice crystal) or a number of large droplets are needed with which the small cloud particles will coalesce—or there may be a combination of both these two processes.

It would seem that smoke particles do not provide either the sublimation nuclei required for the formation of ice crystals or the " giant " nuclei (generally attributable to sea spray) required for the formation of large droplets.

On the other hand, it is fair to argue that smoke particles *can* serve as *condensation* nuclei and must therefore increase the density of condensation nuclei. Thus, even if smoke particles do not directly facilitate rain formation, it cannot be denied that they *do* enhance the formation of small cloud particles—for the simple reason that the available liquid water content has to be divided between the condensation nuclei. Indeed, it might be said that cloudiness rather than rainfall is a characteristic of highly polluted air masses. Nevertheless, it is reasonable to assume that the cloud particles may contribute to light drizzle, especially when the air below the cloud is damp so that the droplets cannot readily be lost by evaporation.

Precipitation is a very fickle element and the degree of variation, as well as the differences between stations, are often hard to establish—partly because of the relatively poor sampling inherent in the usual rain-gauge measurements. However, there is now a good deal of evidence that there *is* some increase of rainfall over Metropolitan areas compared with rural areas.

A. Schmauss (1927) was one of the first to discover a definite surplus in the number of days with *small* amounts of precipitation in a city compared to outlying districts. He found in the city of Munich that the annual number of days with precipitation up to 0·2 inches was 144, whereas in the country the corresponding figure was only 130; this indicates an increase of 11 per cent in the city.

For *total* rainfall amounts, M. A. Bogolepow (1928) using data for a 17-year period found a mean annual value for the city of Moscow of 23·95 inches compared with 21·22 inches at a nearby country station in the same topographical setting—a difference of 10 per cent.

H. Wiegel (1938) using data for a 35-year period found an excess of 1·5 inches per year amounting to 5 per cent in the industrial area of the Ruhr compared with a less polluted area nearby. He also found a marked increase, about 20-30 days per year (an increase 12-18 per cent), in the number of days with small amounts of precipitation in the industrial area compared with the less polluted area.

The U.S. Weather Bureau carried out a similar study in respect of Pulsa, Oklahoma, and found an increase in precipitation in the city area compared with the Airport (6 miles away in open country) of approximately 8 per cent for the year as a whole, 11·5 per cent in the winter half-year and 4·7 per cent in the summer half-year.

Of particular interest as far as this country is concerned are the findings of J. R. Ashworth (1914). Ashworth noticed that at Rochdale, a Lancashire black spot, certain duties which had to be undertaken every day were not as often interfered with by rain on Sundays as on other days, and this casual observation led to an examination of the rainfall records of the town. Rainfall on Sundays was abstracted for a period of 45 years and compared with the rainfall on each of the week days. It was found that the Sunday rainfall was less by 6 per cent than the average of all days and less than any other day of the week.

Here are the average annual totals for each day of the week:

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Avge.	Total
6·01	6·44	6·30	6·45	6·40	6·25	6·56	6·35	44·41

A year consisting entirely of week-days would produce about 44·80 ins. and a year consisting entirely of Sundays about 42·07 ins., a difference of nearly 3 inches a year.

To analyse the rainfall in more detail a continuously recording rain-gauge was set up and the rainfall hour by hour was determined for Sundays and weekdays. When a graph was made for the 24 hours of the day the curve of weekday rainfall was always above the curve of Sunday rainfall during the hours between 7 a.m. and 6 p.m., just the working time of the factories, but at night the two curves ran closely together. Ashworth argued that this showed that weekday rainfall during factory working hours, when smoke is freely emitted, is above what may be called the natural rainfall exhibited by Sunday. Thus different lines of investigation led to the same conclusion. However, it can be shown that there is a more than 1 in 20 probability that the deviation of ·34 in. of the Sunday value from the mean daily total is due to pure chance. Moreover, the positive Saturday deviation of ·21 in. also calls for some explanation. I should mention that we have spent a lot of time trying to find out whether, for comparable topographical situations, industrial areas and nearby rural areas in this country show any significant difference in rainfall amount or in the number of days of light rainfall. In the case of large industrial areas as in the Manchester region and in the Midlands, we were not successful—maybe the pollution is too widespread. But in the case of a fairly isolated urban area such as Lincoln, we did find that, on the average, the nearby country area has only 85 days with rainfall up to 1/10 of an inch compared with 93 days in the city area—a difference of about 10 per cent. We also noted that at Bedford, another fairly isolated urban area, the average annual rainfall is 22·6 in. as compared with 20·8 in. at Cardington in the nearby countryside—again a difference of about 10 per cent.

One point worth mentioning is that, as towns are warmer than the surrounding countryside, there is a tendency for snowfall and snow lying to be less in the centre of the town than in the suburbs or surrounding country. On the other hand, light snow has been known to fall from low stratus or fog within an urban area whilst it has not fallen outside. J. von Kienle (1952) gives a very good example of light snowfall which was entirely restricted to the city area of Mannheim and Ludwigshafen and he advances the view that the effect was caused essentially by nucleation of a super-cooled local fog.

Some recent work by Ross Gunn and B. B. Phillips (1957) of the U.S. Weather Bureau, who used a giant expansion chamber, has indicated that the size of newly formed droplets depends critically upon the cleanliness of the processed air. Their investigations, whilst showing that cloud droplets formed from polluted surface air are mostly too small to fall out as rain, indicated that large droplets formed overhead by condensation in cleaner air may fall through the polluted cloud and initiate rain through association processes. I am not a cloud physicist so cannot speak with authority on the validity of the findings of Gunn and Phillips. However, in regard to the scavenging action of rainfall, it has been shown by C. R. McCully and others (1956), by means of laboratory experiments using fluorescent dust, that rain is effective in scavenging particles of a wide range of sizes from the atmosphere. It was found that as little as four hours of moderate rain can reduce the concentration of large dust particles to 10 per cent. About six to seven hours would be required for reduction of smaller particles to this concentration.

Indeed, Gunn and Phillips suggest, that since pollution is swept out of the atmosphere by diffusion on to cloud

droplets and by precipitation, periods of general cloudiness and rainfall reduce the original nuclei density and permit the subsequently formed droplets to grow still larger, thus increasing the probability of appreciable precipitation, i.e. the rain producing cycle is equipped with a feed back or regenerative mechanism which normally proceeds, in a given mass of air, until the air is appreciably desiccated.

Gunn and Phillips argue that, as condensation nuclei as well as water vapour normally accumulate simultaneously in fair weather, the presence of nuclei may delay the initiation of precipitation until sufficient vertical instability can be established to lift or cool the relatively clean overlying layers. The precipitation cycle may then be re-established. Is it not possible therefore that smoke particles may provide an explanation of a puzzling feature connected with the occurrence of heavy falls of rain for several days in succession in a warm showery weather situation? If large condensation nuclei are essential for the formation of large droplets in the case of a cloud not reaching above the freezing level, where would a sufficient supply of condensation nuclei come from after the first day's heavy rainfall had washed away the existing nuclei? A constant supply of nuclei by smoke particles would remove the difficulty.

Siting of Pollution Sources

An important question in regard to atmospheric pollution concerns the siting of the sources of pollution—that is if we must have them! From the climatological point of view where is the least harmful location? Alternatively, what is the best location, if a choice is possible, of a smokeless zone? First thoughts would suggest that pollution sources should not be sited in valleys and should be located downwind of the prevailing wind, whilst it would be most advantageous for smokeless zones to be located in valleys but upwind of the prevailing wind.

But the matter is not quite so simple as this. It is well known that, as the result of turbulence, the wind will disperse the pollution both horizontally—and vertically too if there is no low inversion. In fact, the Leicester investigation showed that upward diffusion and therefore the vertical gradient of temperature could be more effective than horizontal diffusion; even in strong winds the maximum number of particles was always found fairly close to the centre of the city and fell off rapidly downwind. If there is an inversion, upward diffusion is limited because vertical eddy motion due to local heating is absent or restricted and vertical eddies of any kind die out more quickly than usual. As is common knowledge, with the low inversions associated with anticyclonic conditions, we can get what is now known as a "Smog"—a "Smog" which can be a killer. Because of the ponding of cold air, inversions are very pronounced and more frequent in valley bottoms than on the slopes—hence the need to avoid siting pollution sources in valleys. But it is generally imagined that with a very low inversion there is very little wind and so it could be argued that, in these conditions, the wind direction does not matter very much. This is not quite true. Even with quite low inversions there can be quite an appreciable air movement. Shaw and Owens (1925) calculated that a mean air movement over London of about 12 m.p.h. (say 280–300 miles per day) is sufficient to keep the atmosphere fairly clean, but that scavenging fails if air movement is only about 2–5 m.p.h. (50–100 miles per day).

Now an air movement of a few m.p.h. is not at all uncommon in London beneath a low inversion and the direction is generally from an easterly point, i.e. up-valley and *not* from the south-west, the direction of the prevailing wind. I have looked up all those occasions in the last 40 years of occurrences of fog comparable in duration or intensity with that of the famous "Smog" of December 1952. There were at least 12 such occasions and 8 of these were associated with an

anticyclone centred over the continent and in most cases there were light winds from an easterly point. Now, Mr. H. L. Wright (1939) found that at Kew Observatory the concentration of smoke particles is 3 4 times greater with winds from the east than from other directions!

So you will see that whilst the location of pollution sources, such as factories, downwind of a town is desirable if one wishes to minimise the general incidence of smokiness, i.e. irrespective of smoke density, it is not a good thing to do if the incidence of low inversions, and therefore of a high density of smoke and pollutants are accompanied by a wind, even a light wind in the case of a persistent inversion, from a direction markedly different from that of the prevailing wind. Actually, in the case of London with its enormous suburban areas in which domestic fires add more pollution to the air than factories, I do not think it matters much what the prevailing wind is nowadays. Whether the drift of air under an inversion is from north, south, east or west, thousands are going to suffer anyway. Perhaps a drift from the east, i.e. up the Thames Valley is worst because of the damming effect of high ground upstream.

Smokeless Zones

In regard to the siting of a smokeless zone, I would say put it anywhere in an industrial area rather than not at all. If there is a choice then choose a site where the amount of pollution in relation to the frequency of inversions and/or light winds is judged to be greatest. Actually, results of the Leicester investigations indicated that smokeless zones are unlikely to produce any striking effect unless the smokeless zone is large, owing to the smoke from the surroundings which will be carried into it.

Ideally, a study of climatic data should be a prerequisite to selecting sites for smokeless zones, or, alternatively, to the location, planning and plant design of sources of pollution so that they are least harmful. Obviously, there should be a determination of general weather conditions, especially with regard to the wind and temperature regime. For example, the effect of both wind and turbulence can be readily observed in the difference of pollution for various air masses. According to H. Landsberg (1951) it has been noted that, over cities of the eastern United States, with fresh maritime polar air masses, with gusty winds and steep lapse rate, the pollution is only 1/7th of that with the relatively stagnant modified continental polar air masses. In particular, the passage of marked cold fronts causes an abrupt change in the concentration of smoke particles. In one case, the number of particles dropped 50 per cent. in five minutes, even though there was no rain associated with the front. If possible, there should also be a micrometeorological study of the area in order to determine the fine scale space-time variation of wind and temperatures required for the qualitative and quantitative estimates of atmospheric diffusion. An interesting micro-climatic effect on pollution is produced by the filtering effect of trees, plants, hedges, etc. Even in heavily polluted areas, consistently lower values of pollution are found to the lee of park areas. Finally, it would be necessary to analyse the data into categories typical of various pollution conditions and assess the pollution concentration in respect of each category, taking into account, of course, the location of pollution sources.

Carbon Dioxide and Climate

It is known that smoke particles reduce the electrical conductivity of the atmosphere and I have already mentioned that man-made dust can affect the local radiation balance and therefore influence local climate. Whether the magnitude of this effect is such as to modify the overall radiation balance to the extent of influencing climate beyond the main areas of pollution is doubtful. But it has been suggested that the pronounced warming which has taken place in northwest Europe since the beginning of the

century may be attributable to a man-made increase in the carbon dioxide content of the atmosphere. This idea has been put forward by G. S. Callendar (1938) who estimates that the effect of increased fuel combustion, now about five thousand million tons per year, has been to increase the amount of carbon dioxide in the atmosphere from 290 ppm at the beginning of the century to 320 ppm nowadays. He then proceeds to argue that, because carbon dioxide is almost completely transparent to solar radiation but partly opaque to terrestrial radiation, it acts as a heat trap—allowing the temperature of the air near the surface to rise above the level it would attain if there were no carbon dioxide in the air. Thus, the more the carbon dioxide the bigger the rise in temperature. Callendar calculated that a doubling of the carbon dioxide content of the air could produce a 2°C. increase of temperature. More recently, using more accurate experimental data, G. N. Plass (1956) has calculated that the average temperature at the surface of the earth would rise by 3·6°C. if the carbon dioxide concentration were doubled. I should point out, however, that Plass assumes that nothing else changes to alter the radiation balance when the carbon dioxide amount varies. This means no change in vegetative or forest cover and no change in the carbon dioxide content of the oceans. Maybe, as Callendar contends, it would require hundreds or even thousands of years for the oceans to take up the excess of carbon dioxide, but there is undoubtedly need for more research on the carbon cycle. In any case, even if the incoming radiation from the sun has remained constant, it is not possible to attribute any rise of temperature to an increase of carbon dioxide without knowing the result of variations, if any, in the mean ozone and water vapour content of the atmosphere, as both these gases produce a " greenhouse " effect similar to that of carbon dioxide.

Perhaps I could end by saying that personally I shall be delighted if it were possible to wreck any chance of following up the ideas of Callendar by getting rid of man-made carbon dioxide and smoke—altogether!

REFERENCES

Ashworth, J. R. (1944). *Smokeless Air*, XV, **56**, p.28.

Bogolepow, M. A. (1928). *Met. Zeit.*, XLV, p.152.

Callender, G. S. (1938). *Quart. J. R. Met. Soc.*, **64**, p.223.

Dobson, G. M. B. (1948). *Quart. J. R. Met. Soc.*, **74**, p.133.

Gunn, R. and Phillips, B. B. (1957). *J. Met.*, **14**, p.272.

Hrudicka, B. (1938). *Beitr. Geophys.*, **53**, p. 337,

Kienle, J. von (1952). *Met. Rundschau*, **5**, 7–8, p.132.

Landsberg, H. (1951). *Amer. Met. Monogr.*, **1**, 4.

Leicester Report (1945). *Atmospheric Pollution in Leicester*, H.M.S.O.

McCully, C. R. et alii (1956). *Indust. Engin. Chem.*, Easton, Pa., **48**, p.1512.

Plass, G. N. (1956). *Quart. J. R. Met. Soc.*, **82**, p.310.

Race, E. J. (1949). *J. Soc. Dyers Colourists*, **65**, p.56.

Schmauss, A. (1927). *Met. Zeit.*, XLIV, p.339.

Shaw, Sir Napier and Owens, J. S. (1925). *The Smoke Problem of Great Cities*, London (Constable)

Wiegel, H. (1938). *Veröff. Met. Inst. Univ.: Berlin*, III, **3**, p.52.

Wright, H. L. (1939). *Quart. J. R. Met. Soc.*, **65**, p.411.

RADIOACTIVITY IN THE ATMOSPHERE: ITS ORIGINS AND MEASUREMENT

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Introduction

MEASUREMENTS of the radioactivity in the atmosphere were first carried out more than 50 years ago, and several papers on the radon content of air were published between 1903 and 1908[1], [2], [3]. The subject then lay dormant for a number of years, but with the development of nuclear power and the testing of nuclear weapons, interest has revived, and a world-wide programme of measurement of atmospheric radioactivity—both natural and man-made—is being undertaken during the International Geophysical Year.

Sources of Radioactivity: Maximum Permissible Concentrations in Air

The radioactive content of the atmosphere can be discussed under three main headings:

(i) Naturally-occurring radioactivity.
(ii) Radioactivity from atomic energy installations.
(iii) Radioactivity from atomic test explosions.

There are many different radioactive isotopes to be considered under each heading but in a short paper it will only be possible to discuss a limited number of these.

Members of the National Society for Clean Air will be interested to know that, in contrast with some other forms of atmospheric pollution, maximum permissible concentrations (M.P.C's) have been laid down for all the important radioisotopes by the International Commission on Radiological Protection (I.C.R.P.) which keeps these figures under constant review[4]. A maximum permissible concentration is defined as that which, in the light of present knowledge, is not expected to cause appreciable bodily injury to a person continuously exposed to that concentration throughout his lifetime. In the following paragraphs, where relevant, measured values of specific radioactive elements in air will be expressed in terms of the appropriate M.P.C's.

Natural Radioactivity

The best-known naturally-occurring radioactive elements in the atmosphere are concentrated near the low and high ends of the scale of atomic weights. The lighter radioisotopes such as tritium (H^3), radioberyllium (Be^7) and radiocarbon (C^{14}) are formed by the action of fast cosmic rays on air molecules, mainly in the stratosphere. The total amount of each in the universe is very nearly constant, having built up to an equilibrium value where the number of new atoms created per unit time is balanced by the number which disappear by radioactive decay. The concentrations in ground level air are small and the highest standards of radiochemical analysis and measuring technique are required for their evaluation.

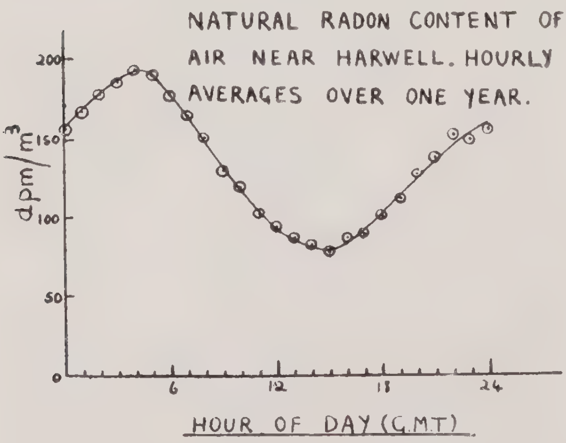
The bulk of the natural radioactive content of the lower atmosphere is due to the heavy gas radon and its daughter products. Radon is one of the elements formed by the radioactive decay of uranium which is present in

greater or lesser degree in rocks and soils all over the world. Being a gas, radon can escape into the atmosphere where it decays radioactively to form a chain of solid daughter products each one of which is produced by the disintegration of the preceding one, thus:

$$\mathrm{Rn} \xrightarrow[3{\cdot}8\mathrm{d}]{} \mathrm{RaA} \xrightarrow[3\mathrm{m}]{} \mathrm{RaB} \xrightarrow[27\mathrm{m}]{} \mathrm{RaC} \xrightarrow[20\mathrm{m}]{} \mathrm{RaD} \xrightarrow[22\mathrm{y}]{} \mathrm{RaE} \xrightarrow[5\mathrm{d}]{} \mathrm{RaF} \xrightarrow[135\mathrm{d}]{}$$

The half-life of each element is marked on the appropriate arrow.

RaA, RaB and RaC are comparatively short-lived and, on average, they are found to be in equilibrium with the parent radon. Thus, although the concentration of radon in air can be measured by trapping the gas in activated charcoal and then passing it into an ionisation chamber, it is more often measured by the simpler process of sampling and counting the daughter products. This may be done by passing air through a suitable filter and counting the collected radioactivity on a conventional geiger counter. Continuous measurements of this type have been made on the airfield near Harwell, and over a period of one year



the mean concentration of radon in the air at ground level was 140 disintegrations per minute per cubic metre (dpm/m^3) which is ·06 per cent. of the M.P.C. for occupational workers defined by the I.C.R.P.[5] This result is of the same order as mean values of 110 and 480 dpm/m^3 found in Cumberland[6] and Cambridge[3] respectively. A mean value of 5500 dpm/m^3, or 2·5 per cent. of the occupational M.P.C. has been observed in London[7] but no satisfactory explanation of this higher figure has been given. It would appear, however, that the natural radon content of air in the U.K. in general is at a very safe level. Higher values are to be expected in countries where the uranium content of rocks and soils are high. Thus in Sweden, where building bricks contain more natural uranium than those used in this country, high concentrations of radon have been observed in badly ventilated rooms in houses. The biggest problem of all is, naturally, in uranium mines where very efficient ventilating systems are now used to maintain the radon in air at a low level.

The Harwell experiments have shown that peaks of up to six times the average value occur during inversion conditions when the low turbulence in ground level air prevents the emanating radon from diffusing up into the atmosphere. The concentration averaged over hourly intervals throughout the year of observation showed a smooth diurnal variation with a peak at 0400 hours G.M.T. and a minimum at 1500 hours.

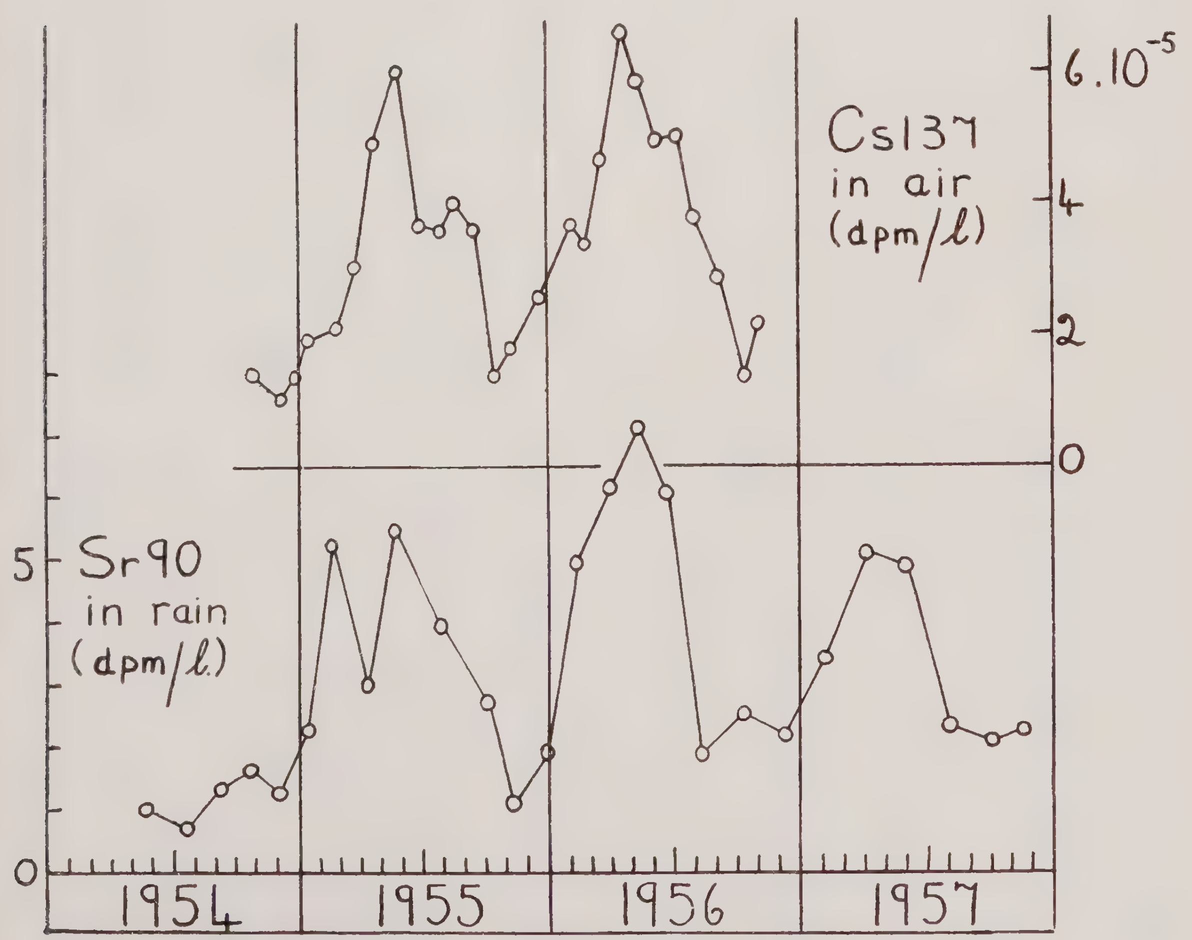
Because of their longer half lives, the daughter products from RaD onwards are washed out of the atmosphere by rain long before they have reached their equilibrium values. By analysing the relative amounts of these it can be deduced that the average life of one of the radon daughter products in the atmosphere is 13 days.

Finally, a similar chain of radioactive elements is introduced into the atmosphere by the decay of thorium deposits but the levels of activity are

much smaller than those of the radon chain.

Radioactivity from Atomic Energy Installations

Most industries have to dispose of some waste products by discharging them into the atmosphere through chimney stacks. The Atomic Energy Authority has had to face the same problem, but under the terms of the Atomic Energy Act, 1954, the amounts discharged have to be authorized jointly by the Ministry of Housing and Local Government and the Ministry of Agriculture and Fisheries who maintain an inspection system to ensure that the permitted levels are not exceeded. The greatest amount of radioactivity so discharged is that due to radioargon (A^{41}) which is formed when the argon in the cooling air of the Bepo (Harwell) and Windscale reactors is bombarded by neutrons on its way through the reactors. This problem will be of little significance in the Calder Hall type of reactor which is the basis of the civil reactor programme as the cooling system in these is of a closed circuit type. A^{41} has a half-life of only 110 minutes and it therefore does not build up continuously in the atmosphere as does the CO_2, for example, from conventional industry. The amount of A^{41} in the atmosphere can be simply measured by a suitable ionisation chamber or geiger counter. At Harwell, the A^{41} discharged from the Bepo stack has been used as a tracer in a detailed study of the diffusion of the plume, and an account of this work is soon to be published in the International Journal of Air Pollution.[8] This study has shown that the mean concentration of A^{41} at ground level is less than 0·1 per cent. of the M.P.C. for occupational workers defined by the



Seasonal variations in Cs^{137} and Sr^{90} at Harwell

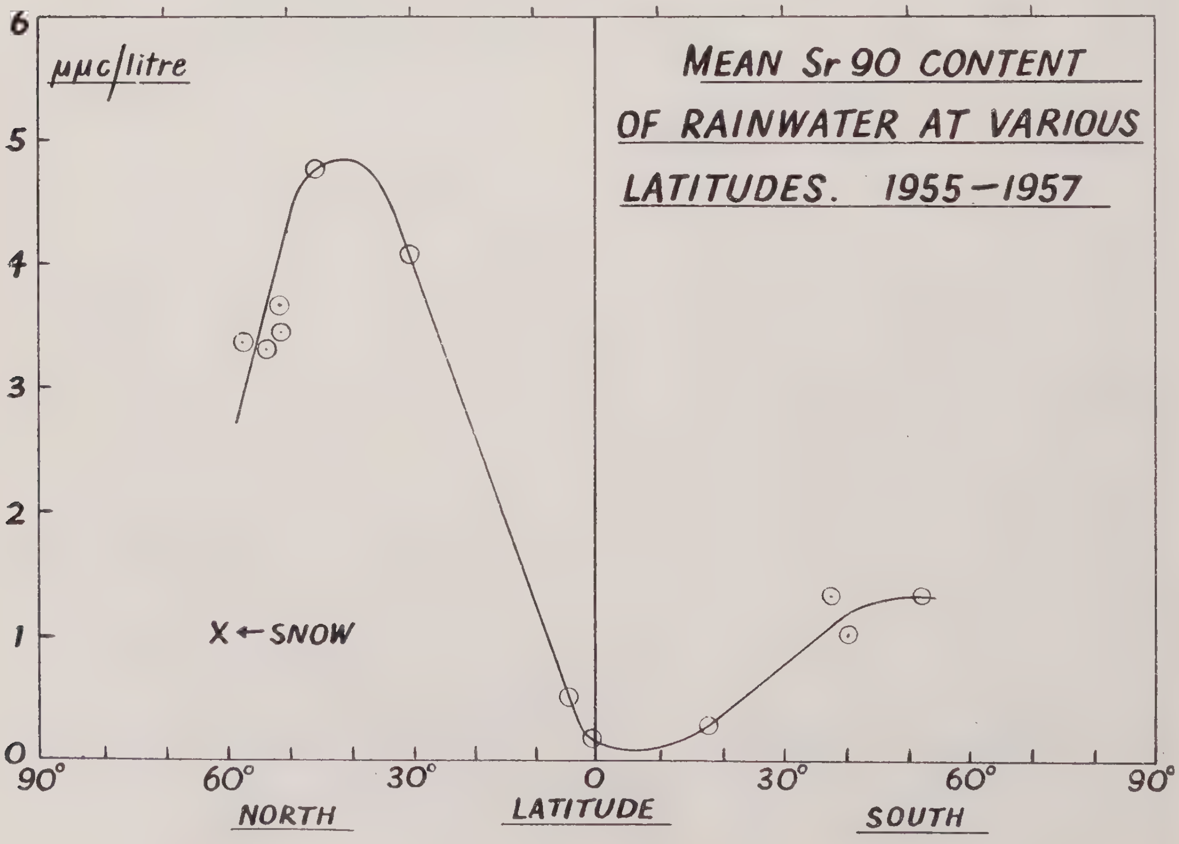
I.C.R.P. or less than 1 per cent. of the M.P.C. recommended for members of the general public.

Radioactivity from Nuclear Weapon Tests

The dust particles from nuclear test explosions contain fission products which consist of a large number of different radioactive isotopes with half-lives varying from a fraction of a second to many years. The simplest type of measurement that can be made is, as in the case of the radon daughter products, to draw air through a filter and measure the collected gross radioactivity on a conventional geiger counter. Measurements of this type have been carried out over successive 24-hour periods at Harwell since 1952.[9] The peak concentrations observed soon after nuclear explosions are generally in the region of 5 dpm/m^3 although individual peaks of up to 25 dpm/m^3 have been observed. The average concentration of activity from all bombs exploded since 1952 is about 1·0 dpm/m^3. This is much smaller than the mean combined activity of RaB and RaC in the atmosphere (280 dpm/m^3 at Harwell) and it may be concluded that the gross *airborne* activity from nuclear test explosions is not a significant problem in this country. However, the major hazard from this dust, as is now well known, arises after it has been deposited, when the critical isotopes Sr^{90} and Cs^{137} enter the following biological chain:

$$(Sr^{90}, Cs^{137} \text{ in rain}) \longrightarrow \text{grass} \longrightarrow \text{cows} \longrightarrow \text{milk} \longrightarrow \text{humans.}$$

The amount of Sr^{90} deposited in the successive years 1955–57 has been fairly constant and the current level in the bones of young children, which is the limiting case, is 1 S.U. (1 S.U. means that there are 2·2 dpm of Sr^{90} per gram of Calcium in the bone.) On this scale, the maximum permissible for occupational workers is 1,000 S.U., and for members of the general public 100 S.U. The Medical Research Council in their report on radiation hazards[10] accepted these figures but added that " immediate consideration



would be required[10] if the concentration in human bones showed signs of rising greatly above 10 S.U. It will be seen that the present amount in children's bones is considerably below these levels.

Both Cs^{137} and Sr^{90} have half-lives of the order of 30 years and they provide useful trace elements for large-scale atmospheric studies. The Atomic Energy Authority operates six stations in the U.K. and thirteen in other parts of the world at which rainwater is collected and analysed for these isotopes.[11] Air is also sampled regularly in the troposphere and stratosphere above the U.K. The amount of Sr^{90} in the samples requires refined radiochemical analysis but the amount of Cs^{137}, after a suitable time delay to allow some shorter-lived isotopes to decay, can be rapidly assessed without chemical processing on a gamma-ray spectrometer which is an electronic device similar in principle to an optical spectrometer.

It has been shown that most of the Sr^{90} deposited is derived from large-scale thermonuclear explosions whose clouds enter the stratosphere and return to earth slowly over a number of years. The rate at which the dust re-enters the troposphere is not constant but varies seasonally, with peaks in the late spring and troughs in the late autumn of each year. The deposition rate is markedly non-uniform with latitude, with a pronounced minimum in equatorial regions and a maximum in the middle latitudes of the northern hemisphere. Although these results were obtained from a programme whose object was to assess the fallout problem on a world scale, the data are of great meteorological interest and contribute to an understanding of the general circulation of the atmosphere.

REFERENCES

1 Eve, A. S., *Phil. Mag.*, **10,** 98 (1905).
2 Eve, A. S., *Phil. Mag.*, **14,** 724 (1907); **16,** 622 (1908).
3 Satterley, J., *Phil. Mag.*, **16,** 584 (1908).
4 Recommendations of the International Commission on Radiological Protection, B.J.R. Supplement No. 6 (1955).
5 Gale, H. J., Peaple, L. H. J., *Int. J. Air Pollution* (in press).
6 Dunster, H. J. (unpublished).
7 Anderson, W., Mayneord, W. V., Turner, R. C., *Nature*, **174,** 424 (1954).
8 Stewart, N. G., Gale, H. J., Crooks, R.N., *Int. J. Air Pollution* (in press).
9 Stewart, N. G., Crooks, R.N., Fisher, Miss E. M. R., A.E.R.E. HP/R 2017.
10 *The Hazards to Man of Nuclear and Allied Radiations.* H.M.S.O. Cmd. 9780.
11 Stewart, N. G., Osmond, R. G., Crooks, R. N., Fisher, Miss E. M. R., A.E.R.E. HP/R 2354.

Removing 12 Tons of Dust an Hour

Simon-Carves Ltd., have been entrusted with the design and construction of the electro-precipitation plant for the first boiler unit at the new Thorpe Marsh power station to be built near Doncaster in the Yorkshire Division of the Central Electricity Generating Board.

This unit will have an output of 550 MW and the precipitator gas volume will be 1,540,000 cubic feet per minute. This is believed to be the heaviest duty yet proposed for precipitators on a single boiler unit anywhere in the world.

The boiler unit, which will be supplied by International Combustion Ltd., will consume about 210 tons of pulverized fuel per hour and the flue gases will be cleaned by an installation consisting of pre-collectors for the removal of the coarse dust followed by electro-precipitators for the collection of the remaining fine particles. The combined guaranteed efficiency will be 99·3 per cent. Under average conditions dust will be removed by the precipitator at a rate of about 12 tons an hour and the stack emission will be considerably less than 0·1 grain per cubic foot.

The cost of the complete dust cleaning plant for this unit will be in the region of £500,000.

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